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Applications for Waiver of Effective Date of the 1981 Model Year Carbon Monoxide Emission Standard for Light-Duty Motor Vehicles—Consolidated Decision; Revised Motor Vehicle Exhaust Emission Standards for Carbon Monoxide (CO) for 1981 and 1982 Model Year Light-Duty Vehicles

ENVIRONMENTAL PROTECTION AGENCY

[FRL 1316-2]

Applications for Waiver of Effective Date of the 1981 Model Year Carbon Monoxide Emission Standard for Light-Duty Motor Vehicles—Consolidated Decision of the Administrator.

I. Introduction

Section 202(b)(1)(A) of the Clean Air Act as amended (Act), 42 U.S.C. 7521(b)(1)(A), establishes the standards applicable to carbon monoxide (CO) emissions for 1977 and later model year light-duty motor vehicles and engines. This section, included in the 1977 amendments to the Act, requires the Administrator of the Environmental Protection Agency (EPA) to promulgate regulations providing that CO emissions for 1977 through 1979 vehicles may not exceed 15.0 grams per vehicle mile. For 1980 model year vehicles, this section requires a standard which does not permit CO emissions to exceed 7.0 grams per mile (gpm). Beginning in model year 1981, this section mandates standards which require a reduction in CO emissions of at least 90 percent from the CO standard applicable to 1970 model year vehicles. As Administrator, I promulgated regulations which set the CO standard for 1981 and later year vehicles at 3.4 gpm.[1]

The 1977 amendments to the Act, however, also include a provision allowing the Administrator, under certain limited conditions, to delay implementation of the 3.4 gpm CO standard. Specifically, section 202(b)(5) of the Act provides that any light-duty motor vehicle or engine manufacturer may apply for waiver of the 3.4 gpm CO standard for any of its 1981 or 1982 model year vehicle or engine models. This section directs the Administrator to make a determination on each application within 60 days from receipt of the application. Should the Administrator decide to grant a waiver for a model, he simultaneously must promulgate standards which do not allow CO emissions over 7.0 gpm for those models covered by the granted waiver application.

Section 202(b)(5)(C) of the Act provides in pertinent part the following:

> The Administrator may grant such waiver if he finds that protection of the public health does not require attainment of such 90 percent reduction for carbon monoxide for the model years to which such waiver applies in the case of such vehicles and engines and if he determines that—
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> (i) Such waiver is essential to the public interest or the public health and welfare of the United States,
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> (ii) All good faith efforts have been made to meet the standards established by this subsection;
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> (iii) The applicant has established that effective control technology, processes, operating methods, or other alternatives are not available or have not been available with respect to the model in question for a sufficient period of time to achieve compliance prior to the effective date of such standards, taking into consideration costs, driveability, and fuel economy; and
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> (iv) Studies and investigations of the National Academy of Sciences conducted pursuant to subsection (c) and other information available to him has not indicated that technology, processes, or other alternatives are available (within the meaning of clause (iii)) to meet such standards.

Congress first set statutory emission standards for hydrocarbon (HC) and CO emissions from light-duty motor vehicles and engines in the 1970 amendments to the Act.[2] Section 202(b)(1) of that version of the Act required that HC and CO emission standards for 1975 and later model year vehicles represent at least a 90% reduction from HC and CO standards in effect in model year 1970. Section 202(b)(5) of that version of the Act, however, authorized the Administrator, upon application of a manufacturer, to suspend for one year the effective date of those emission standards with respect to that applicant.[3]

The criteria for granting a suspension request were essentially the same as those provided in the current section 202(b)(5)(C) waiver provision, with two exceptions. The 1970 version of the Act did not explicitly require the Administrator to assess the effect of the suspension on public health or to take into consideration costs, driveability, and fuel economy in evaluating available technology.

In early 1972, the Administrator received suspension applications from five automobile manufacturers. The Administrator initially denied all five applications in a decision issued on May 12, 1972.[4] In that decision, he determined that no applicant had demonstrated that requisite technology was not available to enable compliance with the statutory HC and CO standards. On appeal, the reviewing court ultimately decided to remand the record to the Aministrator to reconsider his determination regarding available technology.[5] On remand, the Administrator reversed his decision and granted to all manufacturers a one-year suspension of the statutory HC and CO standards until the 1976 model year.[6] He based his reversal on the conclusion that the risk of an errant denial of the suspension requests (severe economic disruption) outweighted the risk of an errant grant (environmental benefits not achieved). The Administrator was particularly concerned about the economic impact of any unanticipated production problems that could occur when manufacturers first began using catalytic converters in production in order to meet the statutory HC and CO standards.

In the 1974 amendments to the Act, Congress further postponed the effective date of these statutory standards until the 1977 model year, and authorized the Administrator to suspend that effective date until the 1978 model year under the same criteria set forth in the 1970 version of the Act.[7] After receiving supension applications from five manufacturers in early 1975, the Administrator issued a decision granting the applications.[8]

In that decision, the Administrator concluded that the requisite technology for meeting the statutory emission standards was generally available to the industry. He further determined, however, that unregulated sulfuric acid emissions resulting from use of the requisite technology presented a significant risk to public health. The Administrator concluded that this risk outweighed any environmental savings achieved by denying the applications, and therefore justified suspension of the statutory standards for HC and CO until the 1978 model year. Before the beginning of that model year, Congress enacted the 1977 amendments to the Act, which set forth the current schedule for implementng (or waiving) the CO emission standards.

Congress intended that any waivers granted under the 1977 amendments be narrow in scope and not apply to the entire industry. While the Act previously directed the Administrator to consider applications for delay of the effective date of statutory emission

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[1] 40 CFR 86.081-8(a)(1)(ii), 44 FR 47884 (August 15, 1979) (revising 43 FR 37972 (August 24, 1978)).

[2] Clean Air Amendments of 1970, Pub. L. 91-604, section 6, 81 Stat. 499 (1970) (current version at 42 U.S.C. 7521(b)(1)).

[3] This contrasts with the current section 202(b)(5), which requires the Administrator to make a separate waiver determination for each model covered by an application.

[4] In re: Applications for Suspension of 1975 Motor Vehicle Exhaust Emission Standards, Decision of the Administrator (May 12, 1972).

[5] International Harvester Co. v. Ruckelshaus, 478 F. 2d 615 (D.C. Cir. (1973)).

[6] 38 FR 1017 (April 26, 1973).

[7] Energy Supply and Environmental Coordination Act of 1974, Pub. L. No. 93-319, 88 Stat. 246 (1974) (current version at 42 U.S.C. § 7521).

[8] 40 FR 1190 (March 14, 1975).

standards on a manufacturer-by-manufacturer basis, section 202(b)(5) requires the Administrator to consider separate waiver applications for each vehicle model at issue.

Requiring the Administrator to make individual determinations for small portions of the total vehicle population indicates that Congress wanted any relaxation of the statutory 90 percent reduction requirement for CO to be applied, where appropriate, as narrowly and precisely as practicable. Indeed, discussions in Congress on the Act's current CO waiver provision include the explicit statement that "[t]he waiver is not a general waiver for all manufacturers, not is it a general waiver for all models of vehicles produced by a single manufacturer."[9] Instead, the waiver provision is to be available for a particular model line of a manufacturer which cannot meet the 3.4 gpm standard across the board in the 1981 model year.[10]

On October 13, 1978, EPA published "Guidelines for Applications for Waiver of the 1981 Carbon Monoxide Emission Standard".[11] These guidelines outlined the information which EPA sought from waiver applicants and direced applicants to submit a separate application for each vehicle model for which a waiver is sought. For purposes of these proceedings, the guidelines defined "model" as synonymous with the term "engine family" as defined in 40 CFR 86.077–2 and 86.078–24(a)(2) through (a)(4) (1977).

On June 25, 1979, General Motors Corporation (GM) filed the first waiver application under this provision of the Act, GM's application requested a waiver for each engine family it plans to market during the 1981 and 1982 model years. Volkswagen AG filed a waiver application on July 3, 1979, covering one of its engine families. EPA also received completed waiver applications, each covering all engine families scheduled for production, from Chrysler Corporation, American Motors Corporation, BL Cars, Ltd., and Toyota Motor Co., Ltd., on July 5, 1979.[12]

From July 9 to July 12, 1979, EPA held a public hearing to consider these applications. EPA received testimony from the waiver applicants, from other automobile manufacturers which had not filed for a waiver, and from suppliers and developers of emission control systems and components. Consistent with the language of section 202(b)(5)(A), I am making a separate determination for each engine family for which a manufacturer has requested a waiver. For the sake of efficiency, however, I am consolidating each of these separate determinations into this decision.[13] After evaluating the applications, testimony, and other information available to me, I have made my determinations regarding the respective waiver applications according to the criteria stated in the Act.

II. Summary of Decision

I have decided to deny most of the waiver applications under consideration in this consolidated decision and to grant the others as specified below. A more detailed discussion of the basis for my decision follows this summary.

In order to grant a waiver for an engine family, I must determine that an applicant has met each criterion specified by the Act. Regarding those engine families by waiver applications which I have denied, I have based those decisions on either of two determinations. For some of those engine families, I have determined that those families can incorporate effective control technology, processes, operating methods, or other alternatives [14] for meeting the statutory 3.4 gpm CO standard for 1981 model year vehicles of those engine families, considering costs, driveability, and fuel economy. For the remainder of those engine families not receiving waivers, I have determined that the applicant has failed to provide sufficient information to establish that such technology is not available.

For the other engine families covered by a waiver application, I have determined that the waiver applicants have met each of the statutory criteria for receiving the waiver.

A. Waiver Applications Granted

The waiver applications which I have decided to grant cover the following engine families:

Manufacturer	Engine family
American Motors Corp.	258 CID.
BL Cars, Ltd	TR 8.
	XJ12.
Chrysler	1.7 liter.
	3.7 liter.
	5.2 liter/4V.
General Motors Corp	2.8 liter/173 CID–2V
	3.8 liter/231 CID–2V.
Toyota Motor Co., Ltd.	88.6 CID

As discussed more fully below, I have concluded that technology will not be available for incorporation into 1981 model year vehicles of these particular engine families to enable these families to meet a 3.4 gpm CO standard. I am prescribing interim CO emission standards of 7.0 gpm for each of the engine families receiving waivers.

Some of these engine families would be capable of meeting the 3.4 gpm CO standard by replacing their catalysts once during their useful life. Such replacement, however, depends on vehicle owners taking affirmative action for which significant disincentives exist. Because many owners are unlikely to replace their vehicles' catalysts, I have determined that effective CO control technology within the meaning of the Act is not available for these engine families.

Protection of the public health does not require attainment of the 3.4 gpm CO standard in model years 1981 and 1982 by any or all of the engine families for which I have granted waivers. The effect on ambient air quality which would result from allowing any or all of the engine families receiving waivers to meet a CO standard of 7.0 gpm for the 1981 and 1982 model years is insignificant. As a result, the impact these waivers would have on any state's ability to meet the National Ambient Air Quality Standards (NAAQS) for CO (in other words, the state's ability to achieve CO levels recognized as protective of public health) also would be insignificant.

I have determined the waives which I have granted to be essential to the public interest. By granting these waivers, I will permit the applicant manufacturers to market one or more engine families which they otherwise may not have been allowed to market, or may only have been allowed to

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[9] 123 CONG. REC. S13703 (daily ed. Aug. 4, 1977) (remarks of Sen. Muskie).

[10] id. at S13702–13703.

[11] 43 FR 47272 (1978).

[12] This decision uses the following abbreviated citation:

AMC App.—American Motors Corporation Application For Waiver of the 1981 and 1982 Carbon Monoxide Emission Standard, dated July 3, 1979.

BL App.—BL Cars Ltd. Application For A Waiver of 1981 and 1982 Carbon Monoxide Emission Standards, dated June 1979.

C App.—Chrysler Corporation CO Waiver Application (3 volumes), dated July 3, 1979.

GM App.—General Motors Application for Waiver of 1981 and 1982 Carbon Monoxide Emission Standard, dated June 1979.

T App.—Toyota Motor Co, Ltd. Request For Waiver [of the] Carbon Monoxide Emission Standard Applicable to 1981 and 1982 Light-Duty Vehicles, dated June, 1979.

VW App.—Volkswagen AG Application For Waiver of the 1981 and 1982 CO Emission Standard for Light-Duty Vehicles, dated July 1979.

Tr.—The transcript of the public hearings held on July 9–12, 1979, on these waiver applications.

Other submissions are cited by the name or initials of the submitting company and the date on the submission, e.g. GM 7/20/79 p.1.

[13] I will review waiver applications which I did not receive in time for consideration in this consolidated decision in subsequent decisions.

[14] For the sake of simplicity, the term "technology" is used in this decision to encompass each of these items (i.e. "technology, processes, operating methods, or other alternatives") listed in section 202(b)(5)(C)(iii) of the Act.

market with the requirement of an expensive catalyst change. These waivers are essential to the public's interest in maintaining a diversified and competitive domestic automotive industry.

Specifically, these waivers enable applicants which have made unsuccessful efforts to meet the 1981 statutory CO standard to continue selling most, or perhaps all, of their respective engine families without requiring catalyst changes. Granting waivers to ensure the viability of these companies serves the public interest both by helping to preserve the level of competition that currently exists in the domestic automotive industry and by avoiding any potential unemployment problems which strict application of the 3.4 gpm standard could have created for their numerous employees.

Each of the waiver applicants contended that it has acted in good faith in trying to meet the 3.4 gpm standard. In general, information in the record supplies support for determining that the applicants have met the Act's good faith criterion. In some limited instances, though, the applicants' respective showings in this regard are at best marginal. Nevertheless, in the absence at this time of any evidence supporting a contrary conclusion (even for the marginal showings), I have determined that the applicants indeed have met the good faith criterion for those engine families for which I have granted a waiver.

Review of studies and investigations of the National Academy of Sciences (NAS) and other information available to me has not indicated that the requisite technology, considering costs, driveability, and fuel economy, is available for these engine families. Available NAS studies only address the issue of whether technology is available in general without considering the issue of availability in the context of the details associated with a particular engine family. The NAS is in the process of preparing a new study on the availability of effective CO control technology. Other available information, obtained from non-applicant manufacturers or part suppliers and developers by subpoena, or from sources not directly associated with proceedings on these waiver applications and included in the record for the determinations on these applications, does not indicate that the requisite technology, considering costs, driveability, and fuel economy, will be available for the engine families receiving a waiver for the 1981 and 1982 model years.

Therefore, concurrently with this consolidated decision I am promulgating regulations establishing a 7.0 gpm CO emission standards for 1981 and 1982 model year vehicles of the engine families in question.

B. Waiver Applications Denied

As stated earlier, I am denying those waiver applications which apply to engine families not included in the above list because I cannot conclude that effective control technology, considering costs, driveability, and fuel economy, is not available to enable those engine families to meet the statutory CO standard in the 1981 model year.

Several applicants submitted emission test data which indicated that some of the engine families covered by their respective waiver applications can meet the 3.4 gpm standard as those engine families currently are designed. Other engine families covered by waiver applications which I have denied will be capable of attaining the 3.4 gpm CO standard in the 1981 model year by adding one or more available features to the design of the engine family. For the remaining engine families covered by waiver applications which I have denied, the applicants have failed to establish that effective CO control technology will not be available to them because they failed to submit emission test results which provide an adequate basis for me to determine whether a given engine family is capable of attaining the 3.4 gpm CO standard.

Considerations of costs, driveability, or fuel economy, whether viewed separately or cumulatively, do not give me a basis for altering my determinations regarding the availability of technology for these engine families which have been denied waivers. The extra costs associated with implementing technology capable of meeting the 3.4 gpm standard for those engine families, while not necessarily insignificant, are not substantial enough compared to the costs of meeting a standard no higher than 7.0 gpm to justify a conclusion that use of that technology is not feasible. The higher prices which manufacturers will need to charge to cover these extra costs will not be so large as to threaten the capabilities of these engine families to achieve or maintain a competitive position in the marketplace by making vehicles of the engine families in question unacceptable to consumers. I have determined, therefore, that these costs do not prevent the requisite control technology from being reasonably available to enable these engine families to achieve the 90% reduction in CO emissions which the Act establishes as an ultimate target for light-duty motor vehicles.

Furthermore, no waiver applicant has presented information which indicates that implementing technology capable of achieving the 3.4 gpm standard would have a sufficient adverse effect on driveability, relative to the driveability levels which an applicant reasonably could attain in conjunction with a standard not exceeding 7.0 gpm, to make the vehicles in question unacceptable to consumers. Nor has any waiver applicant demonstrated that implementation of that technology either will prevent the engine families in question from meeting Federal fuel economy requirements or will cause an unreasonable fuel economy penalty relative to fuel economy levels achievable in conjunction with a standard not exceeding 7.0 gpm.

Thus, while these engine families may meet some, or all, of the remaining statutory criteria for receiving waivers, my determinations regarding available technology, considering costs, driveability, and fuel economy, preclude me from granting the waivers covering these engine families.

III. Discussion

A. Methodology for Assessing Available Technology

A key question I must face in reviewing the waiver applications which I have received is whether technology is available to enable an engine family covered by a waiver application to meet the 3.4 gpm CO standard in the 1981 model year. Sections 202(b)(5)(C) (iii) and (iv) of the Act indicate that Congress intended all vehicles to comply with the Act's 90 percent CO emission reduction requirement were practicable. Section 202(b)(5)(C)(iii) of the Act expressly assigns an applicant the task of establishing that effective CO control technology is not available, taking into consideration costs, driveability, and fuel economy.

1. *Applicants' Positions Summarized.* Each automobile manufacturer has reached a state in its development of CO emission controls at which it has narrowed the range of strategies it contemplates employing to meet the 3.4 gpm standard to, at most, a few alternative systems. To support contentions that effective control technology is not available within the meaning of the Act, each waiver applicant has provided descriptions of the systems it has been considering in its efforts to attain the 3.4 gpm CO emission standard and the emission test results it has measured from vehicles

incorporating those systems. each application proposed that I grant the requested waivers to cover engine families produced in both the 1981 and 1982 model years [15] and that a 7.0 gpm CO standard apply to those families.

a. *American Motors Corporation.* American Motors Corporation (AMC) stated in its application that it currently does not have technology available to it which is capable of meeting the 3.4 gpm CO standard.[16] Moreover, AMC explained that because it lacks the resources to conduct its own basic emission control research it must purchase emission control systems and compotents from other sources.[17] AMC claimed, therefore, that it need two years' additional lead time to adapt and incorporate purchased technology into production before it can comply with all aspects of the 3.4 gpm CO standard.[18] Thus, AMC asserted that effective control technology is not available with sufficient time to permit its two 1981 and 1982 model year engine families to meet the 3.4 gpm standards.[19]

AMC also contended that because of its small share (1.3%) of the U.S. market, granting waivers for its two engine families would lead to no measurable effects on ambient air quality.[20]

b. *BL Cars, Ltd.* BL Cars, Ltd. (BL) generally asserted that technology is not reasonably available to it to enable any of its five engine families to meet the 3.4 gpm CO standard by the 1981 model year.[21] The applicant stated that its emission tests on the engine family designs it has been developing produced results which either exceeded that 3.4 standard or exceeded the design target levels BL believed to be necessary to ensure that production vehicles of an engine family could meet the 3.4 standard during their useful life.[22] BL suggested that because its U.S. market share was so small (0.32 percent of 1978 model year sales), its vehicles' contribution to ambient CO levels is "correspondingly insignificant."[23]

c. *Chrysler Corporation.* Chrysler Corporation (Chrysler) stated that none of its engine families is capable of attaining the 3.4 gpm CO standard with a sufficient degree of certainty to conclude that any of those families could meet certification testing requirements.[24] Chrysler conceded that it could increase its chances of meeting the standards by prescribing a catalyst change during the useful life of the vehicles in question, but claimed that the cost for that procedure (at least $250 per vehicle) made that alternative unfeasible.[25]

Chrysler further stated that granting waivers for all eight of its 1981 and 1982 model year engine families would create only a slight difference in air quality.[26] Chrysler claimed that if it did not receive the requested waivers, it would be unable to market vehicles in 1981 and 1982 and that this would irreparably harm its employees, dealers, stockholders, suppliers, and the communities in which its major operations are located.[27]

d. *General Motor Corporation.* While asserting that it faced some risk of failure to comply with some regulatory emission requirements, General Motor Corporation (GM) stated that the engine families covered by its waiver application probably would meet the requirements of certification testing.[28] GM explained that this projection presumed the addition of an oxidation catalyst downstream from a three-way catalyst, because the three-way catalyst by itself only would have been sufficient to permit most of its vehicles to meet a 7.0 gpm standard.[29]

GM projected that adding the oxidation catalyst (and perhaps a different air switching system) would add $30–$40 dollars to the cost of the vehicles covered by its waiver application.[30] GM claimed that this extra cost of the oxidation catalyst (amounting to an additional $300–$400 million annually if applied industry-wide) would greatly exceed the benefits it produced in reduced ambient CO levels.[31]

Specifically, GM asserted that air quality projections employed by EPA over-estimate future ambient CO concentrations because the projections use unrealistic methodology and differ from recently-measured ambient CO levels.[32] GM concluded that a two-year waiver would have an unmeasurable effect on ambient CO levels and therefore would have no effect on protection of public health.[33]

e. *Toyota Motor Co., Ltd.* The Toyota Motor Co., Ltd. (Toyota) waiver application covered five 1981 and 1982 model year engine families. Toyota stated that its emission test results generally failed to meet its emission design targets for a 3.4 gpm CO standard and therefore produced no assurance that these engine families could meet that standard.[34]

Even using an emission control system which for some families achieved test results below the 3.4 standard although above its emission targets, Toyota asserted that it would incure additional costs ranging from an estimated $90 to $150 per vehicle.[35] Toyota contended that granting the requested waivers would cause a negligible effect on ambient CO levels and therefore would provide only negligible effect on ambient CO levels and therefore would provide only negligible health benefits which would not justify these added costs.[36]

f. *Volkswagen AG.* The Volkswagen AG (Volkswagen) waiver application covered only one engine family comprising only 20% of its projected U.S. sales for the 1981 model year. Volkswagen explained that the remainder of its production could meet the 3.4 gpm CO standard in the 1981 model year and that, in fact, it had already certified those vehicles in California for the 1980 model year at standards of 0.41 gpm HC, 3.4 gpm CO, and 1.0 gpm NOx (oxides of nitrogen).[37]

Volkswagen stated that the engine family covered by its waiver application used a carburetor rather than the fuel injection system employed on the remainder of its engine families. Volkswagen claimed that it had not been able to develop the carburetor system sufficiently to enable it to meet the 3.4 gpm CO standard, but that this system could be produced at a $225 per vehicle savings relative to the fuel injection systems.[38] Volkswagen also claimed that use of the carburetor system would reduce vehicle costs and therefore provide the company with the flexibility to apply these savings to achieve gains in fuel economy.[39] Volkswagen argued that granting a waiver allowing those benefits would serve the public interest, and that any health effects would be limited because

[15] General Motors Corporation's waiver application included a few engine families for which it requested only a one-year waiver (either for the 1981 or for the 1982 model year).

[16] AMC App., p. 5

[17] *Id.* at 4.

[18] *Id.*

[19] *Id.* at 5.

[20] *Id.* at 3.

[21] See, e.g., July 10 Tr., p. 7.

[22] See, e.g., BL App., p. 15.

[23] BL App., p. 2.

[24] C. App., Vol. I, p. B–1.

[25] *Id.*, p. B–3.

[26] *Id., p. B–3.*

[27] *Id.*

[28] GM App., p. 9.

[29] GM App., pp. 8, 11.

[30] *Id.*, p. 315.

[31] *Id.*, p. 48.

[32] *Id.*, pp. 5–6.

[33] *Id.*, p. 6.

[34] T. App., P. 1–6—1–8. Emission design targets are those emission levels which, when achieved by test vehicles, provide a manufacturer with what it deems to be adequate assurance that vehicles of that model will meet emission requirements in mass production.

[35] *Id.*, pp. 1–7.

[36] *Id.*, pp. 1–9.

[37] VW App., p. 3.1; July 12 Tr., p. 3.4.

[38] *Id.*, p. 3.2.

[39] Id.

only an estimated 0.47 percent of the total 1981 model year vehicle population would be involved.[40]

2. *Decision Methodology.* Appendix A to this consolidated decision contains an assessment of technology available to meet the 3.4 gpm CO standard for each engine family in question. These assessments result from a review of the information contained in the waiver applications on these systems and of other information contained in the public record for this consolidated decision.

In evaluating availability of effective control technology, Appendix A assesses the emissions performance of each engine family as described in the waiver application and also of each described engine family after hypothetically factoring in one or more "adjustment factors". The adjustment factors include only those features which are reasonably available to a manufacturer for incorporation into a 1981 model year engine family's design in order to achieve greater reduction of CO emissions (such as an additional catalyst, air injection, or increased catalyst noble metal loadings).[41] Appendix A also projects the emissions performance of the engine family employing a replacement catalyst during its useful life, and of the engine family using both adjustment factors and a catalyst change.

Appendix A employs methodology which applies these few carefully selected, purposely conservative adjustment factors to emission test results supplied by a waiver applicant. This allows me to ascertain not only what CO emission levels the systems as described in the waiver applications can attain but also what these systems could attain had the systems incorporated "state-of-the-art" technology in which a high level of confidence can be placed.[42] EPA's Administrator has used this approach in assessing technology in conjunction with past decisions on applications for suspension of statutory motor vehicle exhaust emission standards.[43]

Appendix A then addresses the engine family under each scenario is capable of "certifying" (passing EPA's certification testing requirements) with 0.41 gpm HC, 3.4 gpm CO, and 1.0 gpm NOx standards in effect.[44] Consistent with the methodology used in the previous suspension decisions and outlined in the waiver application guidelines,[45] Appendix A contains this evaluation for each engine family for which emission test data were available by using a "Monte Carlo" statistical simulation technique. The Monte Carlo technique employs emission test data provided for a vehicle of a given engine family to generate the emission level distributions that would be expected to occur for a large fleet of durability vehicles of that engine family as measured by certification testing.[46] Appendix A assigns a "pass" or "fail" determination to each engine family scenario according to whether the applicable Monte Carlo simulation indicated that more or less than 80% of the vehicles of the engine family in question could meet certification testing requirements for each regulated pollutant if each were tested once.[47] In this manner the methodology takes into account the test-to-test, car-to-car, and deterioration factor variabilities which cause uncertainty in projecting from the few test results provided by an applicant whether an engine family can meet certification requirements when tested. This methodology therefore increases the reliability of projecting from available test results that an engine family will be able to meet certification requirements.

The results from this analysis indicate with high statistical confidence that most of the engine families which were covered by a waiver application and for which adequate emission test data were available can certify to the 3.4 gpm CO standard for the 1981 and 1982 model years. Appendix A provides an assessment for each engine family scenario and describes the adjustment factors employed in projecting each family's ability to certify.

B. *Waiver Applications Granted*

1. *Availability of Technology, Considering Costs, Driveability, and Fuel Economy.*—a. *Unavailable Technology.* I have determined that effective CO control technology, independent of considerations of costs, driveability, or fuel economy, is not available for 1981 model year vehicles of the engine families listed in section II(A) of this decision. These are the engine families which the Appendix A analysis projects as being unable to certify to the 3.4 gpm CO standard in 1981, even after incorporating any reasonably available adjustment factors short of catalyst replacement into the system designs as described by the waiver applicants.

Appendix A projects that the Chrysler 1.7, 3.7, and 5.2/2V engine families could certify at the 3.4 gpm CO standard if they employed both adjustment factors and a catalyst replacement during their useful life. The General Motors 2.8/173–2V FBC and 3.8/231–2V FBC engine families, the AMC 258 CID family, the Toyota 88.6 family, and the BL Cars TR 8 family, could certify at the 3.4 gpm CO standard if they employed only a catalyst replacement during their useful life.

I have determined that *effective* control technology is not available for these eight engine families to meet the 3.4 gpm CO standard. The technology available to these engine families (i.e., technology requiring catalyst replacement) is unlikely to be effective in controlling emissions to meet the 3.4 gpm CO standard because it requires consumers to assume a substantial extra burden in ensuring that these engine families continue to meet the CO standard. Specifically, this technology could require the consumer to assume additional costs (viz., the cost of the replacement) and/or additional

[40] Id., p. 2.1.

[41] Other factors (specifically, deletion of power enrichment and use of insulated or dual-walled exhaust pipes) also were considered available but were not included in the analysis, thereby adding to the conservative nature of the analysis.

[42] The estimates which the methodology employs to account for the effects of the respective adjustment factors on emissions is purposely low compared to measured effects of those factors on emissions.

[43] See, e.g., 40 FR 11900, 11908 (March 14, 1975), 38 FR 10317, 10323 (April 26, 1973). This is not the same methodology which the Administrator used in his initial decision, ultimately remanded by the Federal appellate court in *International Harvester Co. v. Ruckelshaus*, on applications for suspension of the 1975 HC and CO statutory standards.

[44] These are the statutory standards which the Act has scheduled to take effect (absent a statutory waiver) in the 1981 model year. For the sake of simplicity, in discussing an engine family's projected ability to certify, I will refer to this set of standards by merely citing the 3.4 gpm CO standard.

[45] 43 FR 47272, 47276 (October 13, 1978). No applicants commented on the use of this methodology during the waiver proceedings. This methodology was the subject of considerable public comment before the Administrator first employed it to assess available technology as part of the remanded proceedings for suspension of the 1975 model year HC and CO standards. 38 FR 10317, 10323 (April 26, 1973).

[46] The Monte Carlo technique simulated 100 durability tests on a vehicle with available test data by statistically selecting for each simulated test a set of values for car-to-car, test-to-test, and deterioration rate variabilities over the range of values that could be expected to occur in conjunction with vehicles of the design in question. General Motors used this technique in analyzing emission test data as part of its submission for the proceedings for suspension of the 1975 model year HC and CO standards. See 38 FR 10317, 10323 (April 26, 1973).

[47] The Administrator also applied this 80% confidence level in the methodology he used in making his final decision on applications to suspend the 1975 model year HC and CO standards. As Appendix B of that decision explains, EPA has certified many engine families which had not passed certification testing requirements until the second attempt. Because the certification regulations permit an engine family more than one attempt at certifying, the statistical chances of that engine family passing certification testing (by passing on one of the two attempts) actually are higher than 80%. In re: Applications for Suspension of 1975 Motor Vehicle Exhaust Emission Standards, Decision of the Administrator (April 1973) (Appendix B.)

inconvenience (leaving a car for repairs) which there is a natural inclination to avoid.

These disincentives would discourage consumers from obtaining the catalyst replacement while the vehicles are in use.[48] This effect would make it much less likely that after the time scheduled for the catalyst replacement these in-use vehicles of the engine families in question would continue to conform to emission standards. It is the Agency's continuing policy to encourage manufacturers to produce vehicles which will meet emission requirements effectively during their useful life. Denying a waiver application on the ground that a catalyst change can be part of an effective emission control system (without assurance that consumers will replace the catalyst in use) would encourage waiver applicants and other manufacturers to view catalyst replacement as an option in planning to produce automobiles to meet Federal emissions standards.

Appendix A further projects that the BL Cars XJ12 engine family would not be capable of meeting the 3.4 gpm CO standard even if it did employ a catalyst replacement. Thus, I have determined that effective control technology is not available for this family as well to meet the 3.4 gpm CO standard.

b. *Costs, Driveability, and Fuel Economy.* The Clean Air Amendments of 1977 added to the section 202(b)(5)(C)(iii) criterion the requirement to consider costs, driveability and fuel economy in assessing the availability of technology to meet the 3.4 gpm CO standard. Thus, an applicant can demonstrate that technology is not available by establishing that the costs (or driveability or fuel economy penalties) necessarily associated with progressing from the 7.0 gpm standard effective in model year 1980 to the 3.4 gpm goal set for 1981 are significant enough to make the engine family unable to remain reasonably competitive in the marketplace because it would be unacceptable as an alternative for motor vehicle purchasers.[49] For those engine families receiving a waiver, it is unnecessary to consider costs, driveability, or fuel economy in determining the availability of technology, since I have already determined that effective control technology is not available for those families independent of those additional concerns.

c. *National Academy of Sciences Studies and Investigations and Other Information.* As part of my assessment of technology, section 202(b)(5)(C)(iv) of the Act requires that I consider the results of NAS studies and investigations conducted under section 202(c) of the Act regarding available technology, processes, or other alternatives. In 1974, NAS published its most recent study under section 202(c) on technology available to meet the 3.4 gpm CO standard.[50] The 1974 study concluded that the technology was generally available to manufacturers to meet the 3.4 gpm standard, but only at the expense of a fuel economy penalty that would set the industry back to those levels the industry had been attaining in 1970.

Changes in the industry since 1974 limit the current value of this NAS study. Specifically, it is highly questionable whether the fuel economy concerns raised in 1974 still apply to the current state of technology. Since the 1974 report, Congress has passed the Energy Policy and Conservation Act (EPCA)[51] to ensure that the industry achieves specified levels of fuel economy performance. None of the applicants even claimed that it would face problems in meeting the Corporate Average Fuel Economy (CAFE) requirements.[52] Moreover, none of the applicants established that a significant fuel economy penalty will result for an engine family in question if a waiver covering that engine family is not granted.[53] In addition, the record further indicates that an applicant might not be inclined to achieve fuel economy gains beyond the standard at the expense of increasing product costs.[54] In light of these considerations, requiring attainment of the 3.4 gpm CO standard is unlikely to have a significant adverse effect on the fuel economy levels actually attained by waiver applicants in the 1981 model year.

The NAS has not produced any relevant studies or investigations since 1974. EPA has contracted for NAS to provide in the near future an updated version of its 1974 study on the feasibility of complying with a 3.4 gpm CO standard.

The available studies and investigations from NAS drew general conclusions about the availability of effective control technology to the light-duty vehicle industry on the whole rather than for specific engine families. The 1977 amendments to the Act, however, require that I assess the availability of technology for specific engine families covered by a waiver application. Thus, the findings of the available NAS studies do not directly contradict my assessment regarding the unavailability of technology for those engine families for which I have decided to grant a waiver.

In addition, my review of available technology has encompassed other information submitted to the record by non-applicant manufacturers and by part suppliers and developers in response to subpoenas issued under section 307(a)(1) of the Clean Air Act. Several non-applicant manufacturers expressed concerns over their respective technological abilities to achieve the 3.4 gpm CO standard by the 1981 model year.[55] Many of the concerns they raised, however, addressed the potential extra costs of the technology which those manufacturers projected to be necessary to achieve a 3.4 gpm CO standard and did not contest the availability of technology to meet that standard.[56] This additional information, as well as other information available to me and included in the record does not provide an adequate basis for me to alter any conclusions I have reached so far in this decision regarding the unavailability of technology for the particular engine families I have mentioned in this section.

2. *Protection of the Public Health.* Section 202(b)(5)(C) of the Act requires that before granting a waiver covering a given engine family, I must find that protection of the public health does not require attainment of a 3.4 gpm CO standard by the vehicles of the engine

[48] Appendix A summarizes the applicants' estimates of the cost of a catalyst replacement to range between $78 and $278 per vehicle.

Consumer response rates to emission-related recalls indicate that even where replacement is free of charge, a substantial number of vehicles do not receive repairs.

[49] Of course, a manufacturer may remain competitive even though it is unable to market a given engine family. For example, Volkswagen may not be able to market its carburetor-equipped engine family, but the company will still retain its competitive position. In fact, Volkswagen indicated it could sell all the fuel-injected vehicles it could build. July 12 Tr., p. 58.

[50] Report by the Committee on Motor Vehicle Emission of the National Academy of Sciences, dated November, 1974.

[51] Pub. L. No. 94-163, 89 Stat. 871 (1975).

[52] The so-called CAFE requirements are the manufacturers' sales-weighted fuel economy standards set under § 502 of EPCA. See section VIII of Appendix A and the discussion in section III(C)(1)(b)(iii) of this decision.

[53] *Id.*

[54] *Id.*

[55] Ford Motor Company stated it still was uncertain whether its engine families would be able to certify to the 3.4 CO standard in 1981 (July 10 Tr., p. 204). See also, e.g., the testimony of Saab-Scania of America, Inc. (July 11 Tr., p. 5), Toyo Kogyo Co., Ltd. (July 11 Tr., p. 55), or Nissan Motor Co. (July 12 Tr., p. 164).

[56] See, e.g., the testimony of Ford (July 10 Tr., p. 209), Toyo Kogyo (July 11, Tr., p. 54), or AB Volvo (July 11 Tr., p. 92). AB Volvo explicitly stated its belief that technology is available to enable its engine families to meet the statutory 1981 standards at additional costs (July 12, Tr., p. 94).

family receiving the waiver for the model years to which the waiver applies. Upon examination of this issue with respect to each of the engine families for which I have determined that effective control technology, considering costs, is not available, I have found that any health effects resulting from waiving the 3.4 standard for the 1981 and 1982 model years for any or all of these engine families would be insignificant. As a result, protection of the public health does not require these engine families to attain a 3.4 gpm CO standard for those two model years.

The appropriate starting point for determining whether ambient CO levels protect public health is the National Ambient Air Quality Standards (NAAQS) for CO, which have been established under section 109(a) of the Act by regulations of the Administrator.[57] The "primary" (i.e., health-protective) NAAQS for CO are 35 parts per million (ppm) as measured over a one-hour period and 9.0 ppm as measured over an eight-hour period.[58]

Studies have determined that most (and in some areas, almost all) ambient CO originates from motor vehicles.[59] In setting a statutory CO emission standard for light-duty motor vehicles as part of the 1970 amendments to the Act, Congress determined that a 90% reduction from emission levels permitted by the CO standard in effect in 1970 was necessary to permit nationwide attainment of the NAAQS for CO.

The record for the proceedings at hand does not contain any information precisely assessing on an engine family-by-engine family basis the effects on ambient CO levels of granting a two-year waiver of the effective date of the 3.4 gpm CO standard. Appendix B to this decision, however, reviews the information contained in the record and provides an evaluation of the effects of an industry-wide CO waiver.

Appendix B uses EPA's rollback modeling technique [60] gpm, in effect for 1981 and 1982 model year vehicles, would have during 1981–1985 on the following matters: ambient CO air quality,[61] the number of areas from among the nation's 19 worst low-altitude, non-California air quality control regions (AQCRs) for CO that would exceed the health-based NAAQS for CO, and the number of violations occurring within these areas under each of several possible sets of variable conditions (such as the rate of in-use deterioration or the type of emission control system incorporated into vehicles in use).

The extent to which each of these developments occurs naturally depends upon the set of conditions assumed by the projections to be in effect and therefore differs to some extent from several of the projections supplied by the waiver applicants. In a "maximum effect" scenario, Appendix B projects that in 1985, for example, an industry-wide waiver would cause a small but measurable (4%) increase in ambient CO levels. Under those circumstances, the industry-wide waiver would cause a 31% increase in the number of CO NAAQS violations which could occur in these AQCRs and an increase from 11 to 12 in the number of "non-attainment" regions [62] in this group.

In Appendix B's projections under a scenario employing a set of variable conditions judged most likely to occur, however, the effects of an industry-wide waiver would be less pronounced. Under these circumstances, Appendix B projects no change in the overall ambient CO level in 1985 or in the number of non-attainment regions, and only a 4% increase in the number of CO NAAQS violations.

In light of these projections for a two-year, industry-wide waiver, the incremental contribution to ambient CO levels from an individual engine family receiving a waiver would constitute such a small portion of these effects on ambient CO levels that I find it reasonable to characterize that contribution as insignificant. The information supplied by waiver applicants supports this conclusion regarding the incremental contributions of individual engine families.

I also have found that the sum of the incremental contributions to ambient CO levels from those 1981 and 1982 model year engine families for which I have determined that effective control technology, considering costs, is not available still is so small (constituting less than 10% of total light-duty vehicle production) as to be insignificant in its effect on public health. This combined projected effect should be small enough to avoid any modification of any State Implementation Plan (SIP) adopted according to the requirements of section 110 of the Act for the purpose of attaining the NAAQS for CO.

3. *Essential to the Public Interest or to the Public Health and Welfare.* Before I may grant a waiver request, section 202(b)(5)(C)(i) of the Act requires that I determine that granting the waiver is essential to the public interest or the public health and welfare. I have determined that it is essential to the public interest to grant the waiver requests covering those engine families for which I have determined that effective CO control technology is not available.

I have based this determination on the need to protect the public's interest in preserving diversity and competition in the automobile industry. Denying a waiver for one (or more than one) engine family which lacks the technology to continue in production under the 3.4 gpm CO standard would reduce the diversity of choices available to consumers to that extent.[63] It also could create a threat to the ability of that engine family's manufacturer to continue as a competitive force in the marketplace and therefore to the viability of that applicants as a manufacturer of automobiles.[64] This problem assumes added import in cases in which smaller volume manufacturer are concerned, because these manufacturers produce fewer model lines which might substitute for engine families which would be forced out of production and sell fewer vehicles over which they can spread any resulting losses.

Thus, if I denied the waiver applications covering the engine families for which I have determined effective CO control technology is not available, I would be creating a high degree of risk that the range of choices available to meet the automotive needs of consumers may decrease. This results may hinder the automobile industry's ability to meet market demand for automobiles and therefore would be detrimental to the public interest.[65]

[57] 40 CFR 50.8 (1978).

[58] These standards were established by correlating ambient CO levels with observed negative health effects and factoring in a margin of safety. I am not undertaking a review of these standards as part of these proceedings.

[59] See, e.g., Joint Comments from Environmental Defense Fund and National Resources Defense Council, p. 9 (July 30, 1979); T. App., p. 2–15.

[60] The rollback model basically assumes a proportional relationship in calculating CO concentration in the atmosphere on the basis of the rate of CO emissions. A mathematical description of the rollback model is presented in an EPA memorandum from Edward J. Lillis to Charles L. Gray, dated May 14, 1979, and included in the record for these proceedings.

[61] As described by the highest second highest CO reading from any of the 19 air quality control regions examined. The analysis examines the second highest CO reading in a region to represent the maximum ambient CO level reached during a given year so as to negate any biasing effect which an extraordinary high measurement due to highly unusual meteorological conditions might cause.

[62] An AQCR is a "non-attainment" region if measurements in that region produce results which exceed either one of the NAAQS for CO more than once per year.

[63] See AMC App., p. 3, C. App., vol. I, p. III–2.

[64] See C. App., vol. I, p. III–2.

[65] Ford, a non-applicant, indicated in its testimony that as a competitor it would have problems meeting the extra market demand created when an

Footnotes continued on next page

Undermining the competitive abilities of one or more engine families for I have determined effective control technology is not available could be further inimical to the public interest in certain instances by ultimately threatening an applicant's viability, thereby lending to an adverse economic impact on an applicant's stockholders, employees, and suppliers.[66] In this case, in which I already have determined that granting waivers for engine families for which effective control technology is not available still would be protective of public health, I have concluded that it also is essential to the public interest to allow applicants to produce these engine families by granting the waiver applications covering these engine families.

4. *Good Faith.*—In order for me to grant a wavier to any applicant, section 202(b)(5)(c)(ii) of the Act requires that I determine that the applicant in question has made all good faith efforts to meet the emission standards established by this subsection. In the context of this consolidated decision, therefore, I have examined information regarding each applicant's previous and projected efforts toward meeting a 3.4 gpm CO emission standard for the engine families in question.

In response to the waiver application guidelines and Agency subpoenas, each applicant has submitted detailed, specific description of its past, present, and future programs for development of CO emission controls. As a basis for comparisons, the record contains similar, though perhaps less extensive, submissions from other automobile manufacturers which have not filed waiver applications.

The information contained in the record which relates to the good faith criterion tends to support a finding confirming the good faith efforts of each applicant. In some instances, however, the applicant's showing in this regard is at best marginal.[67] The applicants' financial information is rather general and therefore difficult to evaluate in the context of this decision. Nevertheless, I have no basis for concluding that any significant discrepancy exists among them, or in comparison with other manufacturers, with respect to the amounts of resources, relative to company size, which each applicant has committed to the development of CO emission controls.

Of course, each applicant has a natural motivation to present its good faith arguments in the best light possible. The record contains little, if any, evidence from disinterested sources which directly corroborates the information supplied by the applicant.

In *International Harvester Co.* v. *Ruckelshaus,*[68] the court discussed the relative burdens and standards of proof present in proceedings such as these. The court stated that once an applicant produces ostensibly reliable and specific information in support of its position, the Administrator bears the burden of showing the reliability of any methodology employed in reaching a decision adverse to the evidence presented by the applicant.

In this case, I have concluded that I could not reasonably reach a determination that any of the applicants in these proceedings has not taken all good faith efforts to meet the 3.4 gpm CO emission standard. Information submitted by an applicant might tend to ignore or gloss over information pertaining to an existing or potential CO control technology which the applicant failed to pursue in good faith. Nevertheless, the record contains no information indicating that a given applicant acted in bad faith, and therefore provides no basis for refuting the information supplied by the applicants.

Thus, I have determined that each applicant has demonstrated compliance with the good faith criterion set forth in section 202(b)(5)(c)(iii) of the Act.

5. *Conclusion.*—Each of the engine families for which I have determined that effective CO control technology is not available is covered by a waiver application which meets each of the remaining criteria under section 202(b)(5)(C) of the Act. As a result, I am granting a waiver of the effective date of the 1981 statutory CO emission standard for each of these engine families.[69]

C. Waiver Applications Denied

1. *Availability of Technology, Considering Costs, Driveability and Fuel Economy.* a. *Available Technology.*—Appendix A projects that of the remaining engine families covered by a waiver application, the following are capable of passing certification testing requirements by using the design specified in the waiver application:

Manufacturer	Engine family
American Motors	151 CID.
Chrysler	2.6 liter.
General Motors	1.6 liter/98 CID–2V.
	2.5 liter/151 CID–2V.
	4.3 liter/260 CID–2V.
	5.0 liter/305 CID–4V.
	5.7 liter/350 CID–4V (Chev).
	5.7 liter/350 CID–4V (Olds).
Toyota	144/134 CID.

In addition, Appendix A projects that the following remaining engine families are capable of passing certification testing requirements by using the design with one or more adjustment factors added:

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applicant would be unable to market an engine family which could not meet a 3.4 gpm CO standard. Specifically, Ford explained that, because it would receive notice of that extra market demand only shortly before the 1981 model year, it would not have sufficient lead time to meet any more of that demand than already-existing idle capacity would permit. July 10 Tr., p. 203.

[66] C. App., Vol I, p. III–2.

[67] An area that especially concerns me is the paucity of data from the applicants on systems that would appear to represent best effort technology. For example, GM claimed that the emission control system that was their prime system was the system that can generically be called 3-Way plus oxidation catalyst (3W+OC). However, of the 94 vehicles for which GM submitted sufficient durability data, less than one half (43) were equipped with the type of emission control system that GM claimed was its first choice system to meet 3.4 CO. I believe that the 3W+OC system is generally considered the generic system that has the best chance of meeting the 0.41 HC, 3.4 CO, 1.0 NO_x standards. However, AMC submitted data for its 151 CID engine on only a 3-way only system (i.e. without an oxidation catalyst), which was actually a 1980 California certification vehicle, and not a system specifically targeted for 0.41 HC, 3.4 CO, 1.0 NO_x. In addition to this, AMC's efforts to meet 3.4 CO apparently consisted of only two tests.

BL Cars also appears to have limited its investigation to California systems, targeted toward a more lenient CO standard. Toyota's efforts are quite disturbing, especially with one of its smaller engines (88.6 CID). Toyota's statements concerning the reasons for choosing this system, namely the possible CO advantage, are not entirely convincing, since my analysis shows that the pollutant most difficult to control for this system is NO_x, not CO.

Another area of equal concern to me is the class of vehicles for which I could not make a pass/fail determination due to the lack of sufficient data submitted by the applicants. Therefore, I have to deny the waiver applications covering these vehicles. For GM, this "no data" category encompasses 18 "no data" families out of a total of 26 (or 69%) for the 1982 model years, for example. For Chrysler, this problem involves 3 out of 8 (38%) families, for British Leyland 2 out of 5 (40%), and for Toyota 1 out of 5 (20%). This lack of demonstrated effort touches on the good faith issue directly.

I have denied these "no data" applications, but the 1981 model year certification process is already underway. It would appear that the 1981 certification process will be the first time applicants test some of these engine families to determine if they can certify at the 0.41 HC, 3.4 CO, 1.0 NO_x standards.

Although I cannot refuse an application for certification on the basis of the absence of what I consider to be best effort technology, I am putting the industry on notice now that applications for a waiver of the 3.4 CO standard, based on 1981 certification data generated by less than best effort technology, will be evaluated very carefully in light of the "all good faith efforts" criterion of the statute.

[68] 478 F. 2d 615 (D.C. Cir. 1973).

[69] Given the conservative nature of the analysis used to project that effective control technology is not available for these engine families, it remains possible that some of these families still might be able to meet the 3.4 gpm CO standard. Even with my decision to grant waivers for these families, I still expect the applicants to make reasonable attempts to have these families meet the 3.4 gpm CO standard.

Manufacturers	Engine family	Adjustment factors [70]
BL cars	TR 7	Switched AIR system; cleanup oxidation catalyst.
Chrysler	5.2 liter/2V	Catalyst improvement.
Toyota	168/156.4 CID	AIR system.
	A-8	Start catalyst.

[70] Section IV of Appendix A explains how these factors were developed and applied.

On the basis of these projections, I have determined that effective CO control technology is available to the engine families in both of these lists, independent of considerations of costs, driveability, and fuel economy. In addition, Volkswagen in its own application confirms that effective control technology is available to enable its 97 CID engine family to meet the 3.4 gpm CO standard, apart from consideration of costs, driveability, and fuel economy, by using fuel injection rather than a carburetor.

Each of the applicants has argued that inquiry into whether a waiver applicant has met the technology-related criteria established by the Act for receiving a waiver does not end with the evaluation of whether an engine family is capable of certifying to the 3.4 gpm standard. The applicants assert that proper consideration of this area also should take into account the prospects for an engine family's complying with the other emission-related statutory requirements should the 3.4 gpm CO standard go into effect.

More specifically, the applicants content that factors such as prototype-to-production slippage, production variation, and in-use deterioration create a significant risk that production vehicles will not meet the applicable CO emission standard either coming off the assembly line or in use.[71] Under those circumstances, the manufacturer could be subject to liability under EPA's assembly-line testing, recall, and warranty programs. For this reason, the applicants have developed their own emission design targets below the actual CO standard. The applicants contend that only after they meet these targets have they assured themselves that they have minimized to an acceptable level the risk of mass producing vehicles exceeding the CO standard.

I have determined that none of the waiver applicants has established that technology, processes, operating methods, and other alternatives will not be available to enable the engine families which in question here to continue meeting the 3.4 gpm CO standard during their useful life after those families go into mass production.

Section 202(b)(5)(C)(iii) of the Act clearly places the burden of making the necessary showing regarding the available technology criterion with the applicant. EPA specifically indicated the significance of this explanation by requesting information on this point in its "Guidelines for Applications for Waiver of the 1981 Carbon Monoxide Emission Standard" (43 FR 47272, 42276 (October 13, 1978)), in the subpoenas it issued to the waiver applicants, and in the questions propounded to the applicants during the public hearing.

The applicants for the most part have provided EPA with their design targets and with a general list of the factors considered in deriving the design targets for the respective engine families.[72] No applicant, however, provided EPA with actual production vehicle test results supporting the validity of its design targets generally or of the factors (specifically, test-to-test, car-to-car, or deterioration rate variations in production, or prototype-to-production slippage) used to develop those targets.[73]

As explained in the discussion on decision methodology in section III(A)(2) of this decision, the projections of available technology in Appendix A are intentionally conservative in an effort to factor in considerations pertaining to any possible risks that engine families will not meet standards when they are mass produced. Appendix A applies deterioration factors to low mileage emission test data supplied by the applicants in order to project the ability of those tested vehicles in question to meet the 3.4 gpm CO standard for 50,000 miles (the vehicles' legal useful life) and also accounts for the variation in deterioration rate that may occur between vehicles. The methodolgy also statistically applies test-to-test and vehicle-to-vehicle variation factors, which accounts for much of the effects of those variations in production. Finally, in the absence of more specific contrary evidence, I am unable to conclude that any applicant has established that prototype-to-production slippage creates an unacceptable risk that available technology will not meet the 3.4 gpm CO standard once that technology is introduced into mass production.[74]

American Motors raised a unique concern regarding the availability of effective control technology for 1981 model year vehicles of its 151–CID engine family. Specifically, American Motors pointed out that it purchases the technology for this engine family from another manufacturer (General Motors) rather than developing the technology on its own. American Motors contended that even if that technology were capable of meeting the 3.4 gpm CO standard when employed on vehicles of its supplier, it would need at least two additional model years to adapt the purchased technology to its own systems inorder to meet the 3.4 gpm standard.[75]

Despite this argument, I am unable to determine that effective control technology is not available for 1981 model year vehicles of this engine family. Appendix A indicates that the 151–CID engine family can pass certification testing at a 3.4 gpm standard without adding any adjustment factors or a catalyst change. American Motors purchases that engine family as a complete package from General Motors.[76] In fact, the same deterioration factor calculated for the General Motors engine family during certification testing is applied to the engine family once American Motors receives it.

American Motors presented no specific evidence regarding the special kinds of adaptations it needs to perform on the purchased technology before introducing it into production or why it needs an additional two model years to complete the process. The recalibration activities it would have to perform on that engine family during or after General Motors completes durability testing for that family and establishes a deterioration factor should require no more lead time than do recalibration activities normally performed by a manufacturer after it conducts its own durability testing. As the discussion of this engine engine family in Appendix A points out, American Motors has demonstrated that it can complete the necessary recalibrations within nine months (and probably in less time in this case), which should be ample time to allow production of this engine family in

[71] See, e.g., GM App., p. 92; AMC App., pp. 19–20.

[72] See, e.g., AMC App., pp. 23–24; C. App., vol. 1, pp. V–D–31–32; VW App., Appendix 3.

[73] Although specifically asked to explain the basis for the perceived risks assertedly present when putting certified engine families into production, General Motors provided no information to quantify those risks and characterized the matter as only a "minor consideration." July 9 Tr., pp. 213–219.

[74] In fact, in responding to questioning from the EPA Hearing Panel, General Motors indicated that it does not anticipate prototype-to-production slippage in its emission control planning. GM, 7/20/79, Attachment B, pp. 10, 11. Volkswagen indicated that for 1975 model year vehicles meeting newly-imposed interim CO standards, it experienced no noticeable prototype-to-production slippage. VW, 7/23/79, p. 2.1.

[75] *Infra*, section III(A)(1)(a), n. 17 and 18.

[76] AMC App., p. 32.

the 1981 model year. Thus, on the basis of the information the record, I cannot determine that, with respect to American Motors' 151–CID engine family incorporating purchased technology, effective control technology will not be available for a sufficient period of time to enable that engine family to meet a 3.4 gpm CO emission standard in the 1981 model year.[77]

The record did not include sufficient information to make any conclusive determination regarding available technology for the following engine families:

Manufacturer	Engine family
BL cars	MGB.
	XJ6.
Chrysler	2.2 liter.
	5.2 liter/EFM.
	5.9 liter
General Motors	3.2 liter/196 CID–4V
	3.8 liter/231 CID–4V
	4.4 liter/267CID–2V
	4.9 liter/301CID–4V
	Engine family ("EF") P
	EF–H
	EF–M
	EF–K
	EF–J
	EF–W
	EF–N
	EF–V
	EF–Y
	EF–U
	EF–X
	EF–T
	EF–E
	EF–C
	EF–O
Toyota	108 CID.

The waiver applications covering these engine families included no emission test results which the decision's prescribed methodology could use as a basis for evaluating their respective CO emission control capabilities, even though the waiver application guidelines expressly specified the form for the test data.[78] Moreover, no engines families for which the applicants did submit test data were similar enough to these "no data" engine families to provide a basis for assessing the capabilities of those engine families.

As I have mentioned earlier in this section, the Act places with the applicant the burden of establishing the lack of available technology. By failing to supply sufficient data from any engine family through which I can assess adequately the CO emission control capabilities of a particular engine family, the applications I have received covering these engine families have failed to meet the burden which the Act imposes on them. Thus, I cannot determine that, independent of considerations of costs, driveability, and fuel economy, effective control technology is not available to those engine families listed here.

The applicants in question here may reapply for waivers for these "no data" engine families. At that time, I will re-examine the availability of effective control technology for those engine families in light of any new, sufficient emission test data which the applicant may provide.

b. *Costs, Driveability, and Fuel Economy.* I also cannot determine for each of the engine families not granted a waiver that, even after considering costs, driveability, and fuel economy, effective control technology is not available to enable these engine families to meet a 3.4 gpm CO standard in the 1981 model year. Specifically, neither the separate nor the combined effects of the costs, driveability, and fuel economy considerations associated with meeting a 3.4 gpm rather than a 7.0 gpm CO standard are significant enough to make any of these engine families unable to remain reasonably competitive in the marketplace.

i. *Cost.* Appendix A analyzes the costs on a manufacturer-by-manufacturer basis of meeting the statutory CO standard based on 1979 dollars. Table VII–2 in Appendix A provides the following list detailing the extra costs per vehicle (for those families not receiving a waiver) which a manufacturer would have to incur in marketing systems targeted at a 3.4 rather than a 7.0 gpm CO standard: [79]

Manufacturer	Extra cost (1979 dollars)
American Motors	$0
BL Cars	0
Chrysler	14
General Motors	40
Toyota	4
Volkswagen	165

The manufacturer's own estimates of their respective cost differences in attempting to meet the 3.4 versus the 7.0 gpm CO standard are listed in Appendix A's Table VII–3 as follows:

Manufacturer	Extra cost (1979 dollars)
American Motors	No [redacted]
BL Cars	Confidential.
Chrysler	[80]$0.
General Motors	$30–$40.
Toyota	Confidential.
Volkswagen	$225.

[80] The only extra cost Chrysler claimed it would incur in meeting the 3.4 gpm CO standard is the cost of a catalyst replacement, approximately $250. Because I am granting waivers to those families which can meet the 3.4 gpm CO standard only by employing a catalyst change, the $250 figure is not applied here. This table displays the extra cost incurred only by a vehicle in an engine family which has not received a waiver.

These added costs are not large enough to affect significantly the competitive position of any of the engine families not receiving waivers.[81]

The only extra cost figure which even has the potential for presenting a significant risk to an engine family's competitive position is Appendix A's $165 per affected vehicle projected cost for Volkswagen. Volkswagen could save by using the carbureted system which Appendix A projects will be incapable of meeting the 3.4 gpm CO standard on the engine family covered by its waiver application rather than the fuel injection system Volkswagen currently is producing which meets the 3.4 gpm CO standard. Testimony received from Volkswagen at the public hearing on the waiver applications, however, indicated that Volkswagen will be able to sell all the vehicles it produces for the United States market, regardless of whether its vehicles include an extra savings due to use of the carbureted system on the

[77] American Motors' two-year lead time argument was more compelling in its application under section 202(b)(1)(B) for waiver of the effective date of the 1981 NOx standard, which I granted. American Motors does not purchase its 258 CID engine family as a complete package; rather, it assembles that other engine family after purchasing its components separately. Adaptation of this engine family involves much more than mere recalibrations, and thus requires significant additional lead time. This lead time problem provided part to my basis for concluding that American Motors lacked the technological ability to develop technology to enable the 258 CID engine family to meet the statutory 1.0 gpm NOx standard for the 1981 model year. Because the Act directed me to consider those waiver applications on a manufacturer-by-manufacturer rather than engine family-by-engine family basis, I granted a NOx waiver to American Motors which covered its 151 CID engine family as well.

[78] See "Guidelines for Application for Waiver of the 1981 Carbon Monoxide Emission Standard", 43 FR 47272, 27276 (October 13, 1978). In order to be adequate for use in the analysis, the emission test data must come from a vehicle which has accumulated at least 20,000 miles with no major emission control component change and has been subject to at least four valid tests according to the 1975 Federal Test Procedure. Generally speaking, the data which applicants submitted for the engine families in question here did not come from vehicles which had accumulated the mileage necessary to give some indication of the vehicles' durability characteristics.

Section V of Appendix A contains a more complete discussion of how the methodology employed the emission information which manufacturers submitted.

[79] All cost figures cited for a given manufacturer in this subsection are sales-weighted averages.

[81] Of course, to the extent that each manufacturer incurs some extra costs in meeting the 3.4 gpm CO standard, the effect of the extra costs on the competitive positions of the engine families of each waiver applicant will be mitigated. See also the discussion of costs in section III(C)(3) on the public interest criterion.

engine family in question.[82] Loss of the potential $165 (or $225) cost savings, therefore, will not affect the ability of the Volkswagen engine family to remain competitive in the market place and does not prevent me from determining that effective control technology, considering costs, is available to this engine family.

ii. *Driveability.* I also have determined that the sacrifices in vehicle driveability associated with implementing the technology necessary to meet the 3.4 gpm CO standard would not make any of the engine families in question an unacceptable alternative to consumers. For the most part, the applicants included only general allusions to driveability concerns in stating their respective cases for waivers. Toyota, the only applicant which provided any specific driveability information, did not establish that driveability concerns were significantly enough to preclude the practicability for implementing effective technology.[83]

Appendix A's analysis of the driveability issue also refers to information obtained from sources other than the waiver applicants. This information did not indicate that driveability necessarily suffers when vehicle CO emissions are reduced. Thus, I have no adequate basis for concluding that driveability concerns prevent effective control technology from being implemented on any engine family covered by a waiver application.

iii. *Fuel Economy.* I also have determined that any fuel economy penalties associated with effective CO control technology would not seriously impact the acceptability to consumers of the engine families in question. Indeed, at least one applicant confirmed that technology designed to meet the 3.4 gpm standard in model year 1981 incorporated features which actually improve fuel economy relative to the fuel economy levels achieved by systems designed to meet the current less stringent CO standard for 1979 model year vehicles.[84]

No applicant contended that the failure to receive a waiver would preclude the applicant from achieving the Corporate Average Fuel Economy (CAFE) requirements imposed by the Energy Policy and Conservation Act. The estimates from applicants of the projected fuel economy penalty associated with meeting a 3.4 gpm CO standard relative to levels they would be capable of attaining in conjunction with their suggested 7.0 gpm interim standard for 1981 model year vehicles ranged from a maximum 5% penalty for Toyota to a 5–10% penalty for BL.[85] This information does not establish that the fuel economy penalties are significant enough to prevent associated technology from being incorporated into 1981 model year vehicles which would be acceptable to consumers and therefore still could be marketed competitively.

Thus, I have determined that considerations of costs, driveability, and fuel economy whether evaluated separately or in combination, do not give me a basis for concluding that effective control technology is not available for the engine families which Appendix A either projects to be capable of attaining the 3.4 gpm standard or is unable to evaluate because of a lack of sufficient information. For that reason, I am denying the waiver applications under consideration insofar as they apply to these engine families.

c. *National Academy of Sciences Studies and Investigations and Other Information.* As explained in section III (B) (1) (c) of this decision, the most recent study by the NAS (published in 1974) on the availability of technology to meet a 3.4 gpm CO standard concluded that the requisite technology (at the expense of a fuel penalty) was available to the industry as a whole, but reached no conclusions regarding the availability of technology on an engine family-by-engine family basis. As this earlier discussion also explained, the fuel economy penalty projected for technology available in 1974 is not a significant concern now.

Thus, I have determined that the results of the available NAS studies and investigations do not indicate that effective control technology considering costs, driveability, and fuel economy, is not available for the engine families not receiving waivers. I also have made the same determination regarding the indications provided by other information available to me and included in the record. (See the discussion of "other information" in section III (B)(1)(C) of this decision).

2. *Protection of the Public health.* According to the requirements of section 202(b)(5)(C) of the Act the Administrator must find that a waiver application has met each of the specified criteria with respect to a particular engine family before the Administrator may grant a waiver request. Thus, according to the express terms of the statute, there is no need for me to determine whether waiver applications covering engine families for which I already have determined effective control technology, considering costs, driveability, and fuel economy, to be available meet any of the remaining statutory criteria in order for me to deny these applications. Nevertheless, I am addressing these issues in this decision for the purpose of leaving as few matters as possible unresolved.

By the same reasoning I used in section III(B)(2) of this decision, I could conclude that the incremental ambient CO contributions from any engine family for which I have determined effective control technology considering costs, driveability, and fuel economy, to be available also is insignificant. In that case, waiving the 1981 and 1982 statutory CO standard for any one of those engine families arguably still would be protective of the public health.

As I already have noted, however, Appendix B projects that noticeable increases in CO levels could result from an industry-wide waiver under section 202(b)(5) of the Act. This result could hardly be protective of public health when the record indicates that as many as 189 urban areas measured violations of the CO NAAQS in 1978 [86] and that studies project at least some 181 violations still to occur in the 19 worst non-California, low attitude AQCRs, even with a 3.4 gpm CO standard applied industry-wide beginning in the 1981 and 1982 model years.[87] By thus aggravating the detrimental health effects caused by violations of the CO

[82] July 12 Tr., p. 58. When asked specifically during its testimony, Volkswagen was not able to confirm that the savings associated with the carbureted system would be reflected in the selling price of vehicles in that family. *Id.* at 77–81.

[83] Even Toyota's application provided driveability information which was far less specific than suggested by the published waiver application guidelines to provide an adequate basis for determining effects on driveability. Section VIII of Appendix A explains that Toyota never provided information on the relationship between driveability levels and customer satisfaction. In fact, measured driveability did not indicate a definite correlation with CO design levels on all of Toyota's vehicles.

[84] BL, Supplementary Report, July 1979, second page of Section I.

[85] Testimony of Toyota, July 9 Tr., p. 13. Testimony of BL Cars, July 10 Tr., p. 6. As noted in Appendix A, these manufacturers themselves offered conflicting information regarding the extent of the anticipating fuel economy penalty.

Although Volkswagen gave no precise figure, it did assert that use of its carburetor system would permit significant fuel economy gains. In its testimony during the public hearing, however, Volkswagen indicated that its vehicles' fuel economy levels were set more on the basis of marketing strategy than on the basis of technological capability. When asked, Volkswagen gave no assurance that it indeed intended to achieve in production the fuel economy improvements which its alternative system could attain. See July 12 tr., pp. 44–55.

[86] Joint comments from Environmental Defense Fund and national Resources Defense Council, p. 9 (July 30, 1979).

[87] EPA's Revised Air Quality Analysis of Waiving the 3.4 Grams/Mile CO Standard for Light-Duty Vehicles, dated August 1979.

NAAQS which studies already project will exist when 1981 and 1982 model year vehicles are in use, an industry-wide waiver of the 3.4 gpm CO emission standard would not be protective of public health.

Where granting waivers covering vehicles constituting only a small portion of the industry, however, would not create a significant effect on CO levels in non-attainment regions, or would not bring attainment regions into non-attainment imposing the 3.4 gpm CO emission standard on these vehicles is not required to protect public health. Thus it is reasonable within the intent of section 202(b)(5)(C) to provide waivers only on a limited basis by granting waivers covering only that portion of the industry consisting of engine families for which I have determined that effective control technology, considering costs, driveability, and fuel economy is not available (presuming these families also meet the remaining statutory criteria).

Several applicants have contended that recent measurements have shown a significant downturn in ambient CO levels which will lead to nationwide achievement of the CO NAAQS within an assertedly comparable time frame whether or not CO waivers are granted.[88] appendix B nevertheless indicates than an industry-wide waiver could measurably slow the progress towards the health-based CO NAAQS in non-attainment areas. The longer an area is in nonattainment, the longer the public health lacks adequate protection.

General Motors has challenged several specific areas of EPA methodology in measuring and projecting ambient CO levels.[89] Appendix B addresses each of these comments and explains the reasoned basis for the EPA methodology employed to assess both ambient CO levels and the effects which granting these waiver requests may have.

Moreover, in focusing their attention on the need for attainment of the 90 percent CO emission reduction requirement by the 1981 model year, the waiver applicants have misconstrued Congress' intent. Congress did not intend that I reassess the need for attaining the 90 percent reduction requirement by the 1981 model year to decide whether I should grant these waivers; rather, Congress included the public health consideration in section 202(b)(5)(C) of the Act to ensure that any waivers I granted, for a presumably limited number of engine families, would present no significant risk to the public health. In enacting section 202(b)(1) of the amended Act, Congress already had determined that considerations of public health adequately supported requiring the 90% reduction in CO emissions by the 1981 model year.

3. *Essential to the Public Interest or to the Public Health and Welfare.* I have determined that waivers for the engine families for which I have determined that effective control technology, considering costs, driveability, and fuel economy, is available are not essential to the public interest or to the public health and welfare.

On the basis of the information contained in the record, I conclude that in no case is granting a waiver essential to the public health and welfare. No applicant has made a claim that a waiver would enhance the public health and welfare, nor has any information supporting such a finding come to my attention. I have no basis for determining, for example, that manufacturers can achieve the statutory CO standard only at the risk of increasing emissions of other regulated or unregulated pollutants, as EPA's Administrator determined during the suspension proceedings for the 1977 model year motor vehicle exhaust emission standards because of his concerns regarding the uncertain health effects of increased sulfuric acid emissions.[90] Thus, the information elicited during the proceedings at hand has narrowed the scope of my examination of this issue to whether a waiver is essential to the public interest.

Several applicants have stated that though their engine families may have the potential for meeting the 3.4 gpm CO emission standard, the engine families can achieve that emission level only by incurring extra costs (or fuel economy or driveability penalties) which the applicants could avoid under a less stringent CO standard.[91] These applicants contend that I should grant waivers covering these engine families because it is essential to the public interest to avoid any extra costs (or fuel economy or driveability penalties) relating to assertedly marginal improvements in ambient CO levels achieved by attainment of the 3.4 gpm CO standard.

This argument overlooks the purpose for which Congress included the CO waiver provision in the 1977 amendments to the Act. Congress obviously realized that any 1981 model year vehicle model could attain the 90 percent reduction requirement for CO emissions, which it deemed ultimately necessary to achieve ambient CO levels protective of public health, only by incurring some extra cost or perhaps some extra penalty to fuel economy or driveability. As noted earlier, however, Congress intended that waivers be granted on a limited basis only. Thus, it is highly unlikely that Congress envisioned these extra costs (or fuel economy or driveability penalties) alone as justification for granting a waiver request.

The public interest consideration at issue in these proceedings is whether adverse effects from any of these factors are substantial enough to present a significant risk that the applicant will not be able to produce and market the engine family in question and perhaps other engine families as well. Section III(C)(1)(b) of this decision already has examined this aspect of the public interest consideration in discussing the effects of costs, driveability, and fuel economy on the availability of effective control technology.

My conclusion here parallels the one I reached there. Specifically, I have determined that it is not essential to the public interest to grant waivers to engine families which incur costs (or driveability or fuel economy penalties) in meeting the 3.4 gpm CO standard where the costs (or penalties) involved are not so substantial as to present a significant risk to the waiver applicant's ability to produce and market competitively vehicles of that engine family, or vehicles generally.

In its waiver application, Volkswagen argues that a waiver for its engine family designed with a carburetor would serve the public interest in permitting an alternative, potentially cost-saving form of technology to remain in production while Volkswagen further develops that system to meet the 3.4 gpm CO standard.[92] Congress did indicate that it viewed the CO waiver process as a means for permitting the development of innovative technology.[93]

I cannot conclude, however, that granting a waiver to Volkswagen to cover this engine family is essential to the public interest. It is highly unlikely that Congress intended the CO waiver provision to accomodate manufacturers, like Volkswagen, which are able to meet the 3.4 gpm CO standard across the board but which want to market an engine family with alternative technology already employed by much of the industry. Volkswagen asserted

[88] See, e.g. C. App., vol. I, p. C-3; GM App., p.8.

[89] GM App., pp. 33-39. Ford also supplied specific comments on EPA's methodology. Ford, July 9, 1979, Attachment V.

[90] 40 FR 1190 (March 14, 1975).

[91] GM App., pp. 48-51; T. App., pp. 3-4 to 3-6; VW App., pp. 3.1-3.2.

[92] VW App., p. 1.4.

[93] 123 CONG. REC. S13703 (August 4, 1977) (remarks of Senator Muskie).

that use of the carburetor system would permit a $225 cost savings for vehicles of the engine family in question, but was unable to explain, when specifically asked who would benefit from the savings or how the public interest would be served.[94]

4. *Good Faith.* I already have addressed the good faith criterion in section III(B)(4) of this decision. My conclusion here for the engine families for which I have determined that effective control technology, considering costs, driveability, and fuel economy, is available is the same as my conclusion there. Specifically, I have determined that because the applicants for waivers for these engine families have provided evidence supporting their good faith efforts to meet the 3.4 gpm CO standard and because the record contains no information providing any specific evidence to the contrary, I am unable to determine other than that these applicants have met the good faith criterion included in section 202(b)(5)(C)(ii).

5. *Risks in Determining Available Technology.*—In International Harvester Co. v. Ruckelshaus [95] the Federal appellate court reviewed the decision of EPA's administrator to deny a set of applications for one-year suspension of the statutory 1975 model year light-duty motor vehicle emission standards, which included the 3.4 gpm CO standard. The criteria provided in the Act for the Administrator to make his decision were substantially similar to the criteria now provided in section 202(b)(5)(C) of the amended Act.[96]

Among other things, the court stated that the Administrator should have balanced the risk associated with erroneously denying the suspension requests versus the risk of erroneously granting them. In that proceeding, the court indicated that the balance should consider the economic costs (in terms of jobs and misallocated resources) of an erroneous grant.

On remand the Administrator reversed his previous decision and granted the suspension application.[97] The Administrator cited as the most influential factor in his decision the risk that introducing catalyst technology into mass production without a scale-up period of limited mass production could lead to severe economic disruption because of unanticipated difficulties (such as a manufacturer's inability to acquire a supply of acceptable catalysts). The Administrator stated that the one-year suspension of the statutory emission standards would give manufacturers an opportunity to gain experience in the limited mass production of catalyst-equipped cars under conditions of careful quality control while maintaining the accelerating momentum of progress in catalyst development that had occurred during the previous two years.

As part of the waiver proceedings at hand, applicants again have raised concerns over the risks they might face in being unable to implement effective control technology in mass production.[98] Today's circumstances, however, are substantially different from those that existed during the 1973 suspension proceedings.

At that time, the industry had no experience in producing vehicles incorporating catalyst technology; hence, the Administrator determined that the risks associated with implementing a new type of emission control system into production might indeed be significant. Since that time, however, the industry has gained a substantial amount of experience in the mass production techniques and quality control measures associated with catalyst-based emision control technology. The move from today's state of technology to the technology required to achieve the 3.4 gpm CO standard does not require any substantial shift to untried emission control methods. As a result, the uncertainties associated with that move now are much less than those associated with the initial move to catalyst technology.

Moreover, in the proceedings at hand I have made a separate determination regarding the availability of effective control technology, considering costs, driveability, and fuel economy, for each engine family covered by a waiver application. The risks associated with requiring implementation of effective control technology for any one of these engine families are substantially smaller in scope than the risks associated with a determination that effective control technology is generally available for all vehicles of all manufacturers. An incorrect determination here regarding one (or even more than one) engine family will not necessarily prevent that manufacturer, or the industry as a whole, from being able to market other engine families for which effective control technology, considering costs, driveability, and fuel economy, is available.[99] Also, a manufacturer may reapply for a waiver by submitting new information.

In the proceedings at hand, therefore, I have determined for those engine families not receiving waivers that the risks of an erroneous denial of a waiver are justified when compared to the risks attendant to an erroneous grant. I have taken steps to minimize the risk of an erroneous denial by making sure that I base my findings that technology is available to meet certification testing requirements on conservative projections which themselves must meet demonstrate with no less than an 80% confidence level that vehicles of an engine family in question can pass a single certification test. I have found no information in the record that effectively corroborates the concerns raised by the applicants or other manufacturers, which have an obvious interest in a cautious assessment of their respective abilities to meet the 3.4 gpm CO standard.

Section III(B)(2) of this decision discusses the environmental health risks that would be associated with one or more erroneous grants. Even though the health risks associated with erroneous grants may be small, the risks associated with erroneous denials (which do not involve health considerations) also are limited significantly. In addition, an erroneous grant would serve to discourage manufacturers from implementing available effective emission technology as quickly as possible. In light of these counterbalancing risks, and in light of Congress' expressed intent to afford a statutory waiver only in exceptional circumstances rather than on an across-the-board basis,[100] I have concluded that it is appropriate to deny waiver applications insofar as they cover engine families for which I have

[94] July 12 Tr., pp. 77–81. When questioned, Volkswagen did not confirm that any cost savings would be passed on to consumers, or that the waiver would permit any fuel economy gains which it could not achieve otherwise. Because Volkswagen projects that it can sell all the cars it makes even without the $225 savings, it has no market incentive to pass those savings to consumers in the form of reduced prices or better fuel economy.

[95] 478 F. 2d 615 (D.C. Cir. 1973).

[96] See the discussion of the 1970 version of the Act in section I of this decision.

[97] 38 FR 1017 (April 26, 1973).

[98] See the discussion regarding applicants' risks and the establishing of design targets in section III(C)(1)(a) of this decision.

[99] The risk that denial of a waiver request will cause significant harm to an applicant's ability to market vehicles in a competitive manner is substantially less with respect to these engine families, for which the record does not establish that effective control technology is not available, than is the risk with respect to the engine families for which the record demonstrates that technology is available. See the discussion of the public interest criterion in section III(B)(3) of this decision.

[100] While the previous statutory suspension provision directed the Administrator to reach a decision with respect to a manufacturer in general, the current section 202(b)(5) directs the Administrator to examine separately the circumstances pertaining to each model (i.e. engine family). See also 123 CONG. REC. S13702–13703 (Aug. 4, 1977) (remarks of Sen. Muskie).

determined that effective control technology, considering cost, driveability, and fuel economy is available.

6. *Conclusion.*—For the engine families referred to in section III(C) of this decision, I have determined either that effective control technology indeed is available for these 1981 model year engine families, even after considering costs, driveability and fuel economy, or that the waiver applicants have failed to provide adequate data to enable me to make a determination that technology is not available. Thus, even though the waiver applicants may meet one or more of the remaining statutory criteria for granting waivers, I nevertheless must deny the waiver applications covering these engine families.

IV. Interim CO Exhaust Emission Standards

As required by section 202(b)(5)(A) of the Act, I am simultaneously promulgating regulations prescribing interim CO emission standards for 1981 and 1982 model year vehicles of each engine family for which I have granted a waiver of the effective date of the 1981 statutory CO standard. Consistent with the requirements of section 202(b)(5)(B) of the Act and the proposals of each waiver application covering these engine families, I am prescribing an interim CO emission standard of 7.0 gpm for each of these engine families. For these engine families, this action continues in effect for two additional model years the CO emission standard applicable to all 1980 model year vehicles.

Dated: September 5, 1979.

Douglas M. Costle,

Administrator.

Appendix A.—Summary of Technological Capability

Contents

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I. Introduction

The exhaust emission standards for 1981 and later model year light-duty vehicles are currently 0.41 grams per mile HC, 3.4 grams per mile CO, and 1.0 grams per mile NOx. Section 202(b)(5)(A) of the Clean Air Act, as amended, 42 U.S.C. 7521(b)(5)(A) provides the opportunity for manufacturers to request a waiver of the 3.4 grams per mile CO standard to 7.0 grams per mile during model years 1981 and 1982. Six vehicle manufacturers have applied for this waiver. These manufacturers are American Motors, Chrysler, General Motors, British Leyland, Toyota, and Volkswagen.

This appendix deals with the technological capability of those manufacturers to meet the 1981 and 1982 CO standard of 3.4 grams per mile. This appendix relies on three previous technical appendixes, particularly for discussion of the Monte Carlo simulation utilized in this analysis. These appendixes are:

1. Appendix B, Technical Appendix, to the Decision of the Administrator on Remand for the United States Court of Appeals for the District of Columbia Circuit, April 11, 1973.

2. Appendix A, Technical Appendix, to the Decision of the Administrator In re: Applications for Suspension of 1976 Motor Vehicle Exhaust Emission Standards, July 30, 1973.

3. Appendix A, Technical Appendix, to the Decision of the Administrator In re: Applications for Suspension of 1977 Motor Vehicle Exhaust Emission Standards, March 5, 1975.

As indicated in Section 202(b)(5)(c)(iii), the technological feasibility determination is based on the consideration of technological capability, cost, driveability, and fuel economy. This appendix contains discussion of each of the above topics, in the same order as in the Act.

II. Summary of Technological Capability

Tables II–1 to II–6 summarize the capability of the six applicant manufacturers to meet the 1981 and 1982 emission standards. The standards considered in these tables are 0.41 HC, 3.4 CO, 1.0 NOx.

A guide to the summary tables is as follows. The first column lists engine family. The second column which lists per cent of model year 1981 sales is deleted because the values were derived in most cases from manufacturer's confidential sales estimates. The "as received" column refers to the data submitted by the manufacturer. "Improvements" refer to the projected technological improvements (factors) applied to the data. Catalyst change is self explanatory.

The "no data" category is an abbreviated notation for the lack of acceptable data to perform EPA's technological analysis. The applicants have known for about six years what sort of data is necessary for EPA to make a determination whether or not a given vehicle would be projected to pass or fail a set of standards. Unfortunately, in many cases there was a lack of acceptable data for specific engine families. This effectively precluded EPA from making a pass/fail determination for those families. In these cases the families are called "no data" and no pass/fail determination was made.

Table II–1.—*Applicant: AMC*

	Percent estimated 1981 sales	Pass as received?	Pass with improvements?	Pass with catalyst change?	Pass with both?
Engine:					
151		Yes (from GM)	Yes (from GM)	Yes (from GM)	Yes (from GM)
258		No	No	Yes	Yes

Table II–2.—*Applicant: Chrysler*

	Percent estimate 1981 sales	Pass as received?	Pass with improvements?	Pass with catalyst change?	Pass with both?
Engine:					
1.7		No	No	No	Yes
2.2		(1)	(1)	(1)	(1)
2.6		Yes	Yes	Yes	Yes
3.7		No	No	No	Yes
5.2/2V		No	Yes	Yes	Yes
5.2/4V		No	No	No	Yes
5.2/EFM		(1)	(1)	(1)	(1)
5.9		(1)	(1)	(1)	(1)

[1] No data.

Table II–3A.—*Applicant: GM (1981)*

	Percent estimated 1981 sales	Pass as received?	Pass with improvements?	Pass with catalyst change?	Pass with both?
Engine:					
1.6/98		Yes	Yes	Yes	Yes
2.5/151–A		Yes	Yes	Yes	Yes
2.8/173		No	No	Yes	Yes
3.2/196		(1)	(1)	(1)	(1)
3.8/231–2V		No	No	Yes	Yes
3.8/231–4V		(1)	(1)	(1)	(1)
4.3/260		Yes	Yes	Yes	Yes
4.4/267		(1)	(1)	(1)	(1)
4.9/301–A		(1)	(1)	(1)	(1)
5.0/305		Yes	Yes	Yes	Yes
5.7/350–C		Yes	Yes	Yes	Yes
5.7/350–O		Yes	Yes	Yes	Yes
EF–P		(1)	(1)	(1)	(1)
EF–K		(1)	(1)	(1)	(1)

Table II-3A.—*Applicant: GM (1981)*—Continued

	Percent estimated 1981 sales	Pass as received?	Pass with improvements?	Pass with catalyst change?	Pass with both?
EF-W		(1)	(1)	(1)	(1)
EF-N		(1)	(1)	(1)	(1)
EF-U		(1)	(1)	(1)	(1)
EF-X		(1)	(1)	(1)	(1)
EF-E		(1)	(1)	(1)	(1)
EF-O		(1)	(1)	(1)	(1)

[1] No data.

Table II-4.—*Applicant: British Leyland*

	Percent estimated 1981 sales	Pass as received?	Pass with improvements	Pass with catalyst change?	Pass with both?
Engine/model:					
120 cu. in./MGB		(1)	(1)	(1)	(1)
2.0L/TR7		No	Yes	Yes	Yes
215 cu. in./TR8		No	No	Yes	Yes
258 cu. in./XJ6		(1)	(1)	(1)	(1)
326 cu. in./XJ12		No	No	No	No

[1] No data.

Table II-5.—*Applicant: Toyota*

	Percent estimated 1981 sales	Pass as received?	Pass with improvements?	Pass with catalyst change?	Pass with both?
Engine:					
88.6		No	No	Yes	Yes
108		(1)	(1)	(1)	(1)
144/134		Yes	yes	Yes	Yes
168/156.4		No	Yes	Yes	Yes
A-8		No	Yes	Yes	Yes

[1] No data.

Table II-6.—*Applicant: VW*

	Percent estimated 1981 sales	Pass as received?	Pass with improvements?	Pass with catalyst change?	Pass with both?
Engine:					
97 in³/FBC		No	No	No	No

III. Statistical Treatment of the Data

No changes have been made in the basic Monte Carlo methodology since its last use in a technical appendix. This methodolgy has been discussed in three previous technical appendixes:

1. Appendix B, Technical Appendix, to the Decision of the Administrator on Remand for the United States Court of Appeals for the District of Columbia Circuit, April 11, 1973.

2. Appendix A, Technical Appendix, to the Decision of the Administrator In re: Applications for Suspension of 1976 Motor Vehicle Exhaust Emission Standards, July 30, 1973.

3. Appendix A, Technical Appendix, to the Decision of the Administrator In re: Applications for Suspension of 1977 Motor Vehicle Exhaust Emission Standards, March 5, 1979.

IV. Factors

With respect to the vehicle emission data submitted by the manufacturers for EPA analysis, vehicles are often run and tested over durability mileage accumulation schedules without using the best technology that is available to the manufacturer for certification in the 1981 model year. There are many reasons why this occurs. First, such technology may have simply not been available in quantity when fleets of vehicles began mileage accumulation. Second, all vehicles submitted for EPA staff analysis may not have been specifically designed for the 1981 and 1982 Federal emission standards. Also the manufacturer may wish to maintain some technologies (with known durability) in reserve if their low mileage testing indicates that such technology may not be needed for compliance with the target emission standards. In addition, technology may not appear on durability vehicles because the manufacturer has made a

decision that the technology would be too costly for production vehicles.

To account for some of the deficiencies in emission hardware, factors have been applied to some of the emission data submitted by the manufacturers. Due to substantial lead time problems for implementation of new or additional technology by the 1981 model year, these factors have been applied only for currently known hardware that can be implemented in 1981 certification and production. These improvements have been basically limited to additional catalyst (i.e., the addition of oxidation catalyst in some cases), the addition of air injection, and increased noble metal loadings of catalysts.

The factors that have been applied to the data are dimensionless numbers that represent the improvement in emission performance that is predicted for the more effective emission control technology. The factors are derived from data that reflect the emission performance of a vehicle with and without the more effective technology. For example a factor for CO of 0.90 indicates that a 10% reduction in CO is projected for the use of the more effective technology. In addition, when there are several different sources for the same improvement, EPA uses a conservative estimate of that projected factor, i.e., a factor greater in absolute value than that indicated by most of the date (e.f., Table IV–3).

Other factors which were developed, but not used in the following analysis include factors for:

- Deletion of power enrichment.
- Use of Insulated or dual-walled exhaust pipes.
- Use of exhaust port liners.
- Use of throttle body fuel injection.
- Use of multiple point fuel injection.
- High energy ignition.

Although the deletion of power enrichment and the use of insulated or dual-walled exhaust pipes were considered feasible for 1981, they were not used. Therefore, because of this conservatism, the manufacturers may have some additional cushion for certification. Use of the other items was not considered possible for most manufacturers for most engine families before the 1982 model year.

Chrysler Improved Catalyst Factor

The vast majority of vehicles tested by Chrysler Corporation used 3-way catalysts having platinum to rhodium (Pt:Rh) ratios of 10:1. The overall vehicle Pt:Rh ratios (including the oxidation catalysts) were approximately mine mix, according to Chrysler [5 at 117].* Chrysler has previously maintained a corporate policy that 3-way catalysts could not be used in production that had Pt:Rh ratios below 10:1 [3 at Vol. II, Sec. B–4, page B4–5]. That policy has recently been revised to include lower ratios in Chrysler test programs [5 at 116–117].

The EPA technical staff is in general agreement that it is desirable to utilize the minimum necessary loadings of all noble metals if the emission standards can be met with such loadings. However, if the emission standards can not be met with these loadings alternate loadings must be considered.

To correct the Chrysler vehicle data for increases in Rh loading, a factor has been developed.

The data in Table IV–1 were submitted by Chrysler in their CO waiver application.

Table IV–1.—*Aged Catalyst Samples Tested on Car 369*

Catalyst	75 FTP			
	HC	CO	NOx	Reference [3]
Chrysler standard 3W (90 in³, 10:1 Pt:Rh)	.35	4.79	0.70	Vol. II, pB4–8 and B4–42.
Engelhard Volvo 3W (102 in³, 5:1 Pt:Rh)	.32	3.66	0.43	Vol. II, pB4–40.
UOP #1941	.25	4.47	0.83	Vol. II, pB4–39.
UOP #1970	.29	4.58	0.80	Vol. II, pB4–39.
GM 160	.36	4.03	0.39	Vol. II, pB4–42.
GM 260	.31	4.49	0.49	Vol. II, pB4–42.

The factors for the difference between the Engelhard catalyst with a 5:1 Pt:Rh ratio and the Chrysler standard catalyst are .32/.35 = 0.91 for HC, 3.66/4.79 = 0.76 for CO, and 0.43/0.70 = 0.61 for NOx.

The data in Table IV–1 that relate to UOP and GM catalysts are provided only to indicate that several improvements can be made compared to the standard Chrysler catalyst.

If it is only necessary to go to some intermediate Pt:Rh ratio, the Chrysler CO waiver application contains data for going from 10:1 to 7:1 Pt:Rh. These data are shown in Table IV–2.

Table IV–2 *.—*Increased Pt:Rh Ratios With Standard Chrysler Catalyst Aged 300 Hours*

	Efficiency		
	HC	CO	NOx
Pt:Rh:			
7/1	76	70	81
10/1	73	63	80

* Volume II, page B4–5.

*The brackets contain the designation x at y. This means the reference is located in reference number x (listed at the end of this document) at page number y.

The factors here are (1−.76)/(1−.73) = 0.89 for HC, (1−.70)/(1−.63) = 0.81 for CO, and (1−.81)/(1−.80) = 0.95 for NOx.

The data in Tables IV–1 and IV–2 are shown to be directionally correct by vehicle data in reference number 1 on page 7–456. These data indicate factors of 0.72 for HC, 0.67 for CO, and 0.44 for NOx when the Pt:Rh ratio is changed from 19:1 to 5:1.

To be somewhat conservative in this analysis, only the factors for the change from 10:1 to 7:1 Pt:Rh were utilized in the Monte Carlo analysis. Since Chrysler plans to increase the size of their catalysts in 1981, an additional safety margin is present.

GM Improved Catalyst Factor

The GM waiver application contained vehicle data using a number of catalyst types (i.e., monolithic 3-way catalysts, pelleted 3-way catalysts, monolithic 3-way plus oxidation catalysts, and pelleted 3-way plus oxidation catalysts). Also a variety of catalyst volumes and noble metal loadings were utilized on the GM vehicles. Since GM has indicated that their prime system for model years 1981 and 1982 (for 3.4 CO) will include a 3-way plus oxidation catalyst [4 at 187 to 207], this system was studied in detail.

GM has claimed confidentiality for the majority of the details concerning the various catalysts, so an in-depth discussion of the analysis can not be presented in this document. However, the factors which were derived for the improved GM catalyst are 0.68 for HC, 0.48 for CO, and 0.66 for NOx. The actual values used in the Monte Carlo were 0.75 for HC, 0.60 for CO, and 0.75 for NOx. These factors applied only to some vehicles equipped with 250 cubic inch, pelleted, 3-way plus oxidation catalysts.

Start Catalyst Factor

The available CO control technology includes light-off or start catalysts. Start catalysts are small in size, have low thermal inertia and are mounted close to the engine. This combination of factors leads to rapid light-off for the start catalyst, which tends to lower HC and CO emissions.

The data used to develop the start catalyst factor came from Automobile Emission Control—The Current Status and Development Trends as of March, 1976 (S.R. 1976) page 4–14 and from subpoenaed information from Englehard Industries [16 at Section II]. This data is shown in Table IV–3.

Table IV–3.—*Start Catalyst Effect*

	HC	CO	NOx
	0.48	0.36	1.01
	0.62	0.45	1.00
	0.70	0.55	1.00
	0.66	1.01	0.96
	0.57	0.46	0.50
	0.66	0.72	1.20
	0.25	0.62	* 0.78
Average factor	0.56	0.61	0.98
Factor used in Monte Carlo	.7	.7	1.0

* Englehard data.

The average factors were 0.56 for HC, 0.61 for CO, and 0.98 for NOx. The technical staff has conservatively used factors of 0.7/0.7/1.0 for HC, CO, and NOx respectively in the Monte Carlo.

Air System Factors

The factors for AIR used in the Monte Carlo were 0.8, 0.8 and 0.95 for HC, CO, and NOx respectively.

The factors used for AIR vs. PAIR were 1.00, 0.90 and 1.00.

"To date the most successful exhaust treatment technique used commercially has been air injection into the exhaust system [18 at 210]". Although this claim is now outdated, it does indicate that significant emission reductions are possible with the addition of an AIR System.

Data from Volvo [10 at 4–39] and Saab [11 at Enclosures 2 and 5] were used in calculating the AIR factor.

The data from Saab Enclosure 5 shows the influence of AIR vs. no AIR on Bag 1 CO results only. In order to translate this data into FTP results, the following formula [17 at 32988] is used:

$Ywm = (0.43\ Yct + 0.57\ Yht + Ys)/7.5$

Where:

Ywm = Weighted mass emissions of each pollutant, i.e. HC, CO, or NOx, in grams per vehicle mile.

Yct = Bag 1 = Mass emissions as calculated from the "transient" phase of the cold start test, in grams per test phase.

Yht = Bag 3 = Mass emissions as calculated from the "transient" phase of the hot start test, in grams per test phase.

Ys = Bag 2 = Mass emissions as calculated from the "stabilized" phase of the cold start test, in grams per test phase.

Enclosure 2 of the Saab subpoena submittal is a table of "Selected Bag Results From Various MY80 Certification Tests" which includes data from a turbocharged engine. The average of twelve tests are as follows:

Yct = Bag = 43.09 grams CO
Ys = Bag 2 = 5.68 grams CO
Yht = Bag 3 = 8.23 grams CO
Ywm = [0.43 (43.09) + 0.57 (8.23) + 5.68]/7.5
Ywm = 3.85 grams/mile CO

Saab enclosure 5 shows the influence of air injection on CO in Bag 1 at 4,000 miles and at 50,000 miles for a turbocharged engine.

At 4,000 miles, Bag 1 CO was reduced by 11 grams, which when subtracted from Yct, gives 32.09 grams CO in Bag 1 for an AIR equipped engine.

Ywm equals 3.22 grams/mile for the AIR equipped vehicle at 4,000 miles.

At 50,000 miles the bag 1 results were reduced by 18 grams, giving 25.09 grams CO in Bag 1.

Ywm at 50,000 miles * equals 2.82 grams/mile CO.

The average of the 4,000 mile and 50,000 mile emissions is as follows:

Ywm w/AIR = (Ywm 4K) + (Ywm 50K)/2 = (3.22 + 2.82)/2 = 3.02 grams/mile CO with AIR

Ywm no/AIR = 3.85 grams/mile CO as calculated previously

The AIR System Factor is:

$$\text{AIR System Factor for CO} = \frac{\text{Ywm w-AIR}}{\text{Ywm no/AIR}}$$

$$\text{AIR System Factor for CO} = \frac{3.02}{3.85} = 0.78$$

The Volvo and Saab data is combined in Table IV–4.

Table IV–4

Vehicle		Gms/mi*		
		HC	CO	NOx
Volvo	No/Air	0.19	2.85	0.14
KMU 748 Auto	W/Air	0.15	2.36	0.13
Factor-Air		0.79	0.83	0.93
Volvo				
KFL 989-Manual	No/Air	0.21	2.79	0.11
	W/Air	0.15	2.16	0.10
	W/Pair	0.15	2.43	
Factor-Air		0.71	0.77	0.91
Factor-Pair vs No/Air		0.71	0.87	
Factor-Air vs Pair		1.00	0.89	
Saab Turbo	No/Air		3.85	
	W/Air		3.02	
Factor-Air			0.78	
Factor-Air (avg-Volvo + Saab)		0.75	0.79	0.92
Factor Used in Monte Carlo-Air		0.80	0.80	0.95
Factor used in Monte Carlo-Air vs Pair		1.00	0.90	1.00

*NOTE.—Factors are dimensionless.

V. Discussion of Individual Manufacturer's Technical Capability

This section will discuss all vehicles which (1) were submitted by each of the six applicants and (2) also are acceptable for input into the Monte Carlo simulation. Acceptable for input means (1) that the vehicle is a durability vehicle which has accumulated a minimum of 20,000 miles with the same major emission control components and (2) that a minimum of four valid 1975 FTP tests have been conducted on the vehicle.

Details of the pass/fail determinations in Section II are also presented here. To pass the 1981 and 1982 emission standard (of 0.41 HC, 3.4 CO, 1.0 NO_x), the probabilities of passing each individual pollutant must be greater than or equal to 80%. If the probability of passing only HC, for example, is less than or equal to 79%, the vehicle fails—even if the probabilities for CO and NO_x greatly exceed the 80% cut point.

Due to time constraints for this analysis, pass/fail analysis is provided only for emission standards of 0.41 HC, 3.4 CO, and 1.0 NO_x. The complete data needed for a similar analysis at emission standards of 0.41 HC, 7.0 CO, and 1.0 NO_x are presented in the attached Monte Carlo output, but this analysis was not completed. Consequently, vehicles designed for a 7.0 CO standard are included in the following discussions of vehicles which were acceptable for entry into the computer analysis, but are not discussed at length afterward with respect to compliance at 7.0 CO.

In order that the Monte Carlo analysis not be cluttered with hundreds of failing vehicles utilizing inappropriate technology, prior certification vehicles are not considered in this analysis except in special cases where a manufacturer's ability to comply with the 1981 and 1982 emission standards is directly affected. It is not surprising that the durability vehicles from past certification would fail to achieve the 3.4 CO standard for two reasons. First, this standard represents a substantial reduction in CO from prior model year standards. And second, major changes in technology are being planned for introduction in 1981 by the vehicle manufacturers to achieve the more stringent standards.

If a manufacturer's prime (prime means the system most capable of achieving the 1981 standards) 1981 emission control system has been tested in prior certification, (generally 1980) these data are included in the analysis.

A. American Motors

Data from a total of 7 durability vehicles were reported by AMC in their waiver application (Reference 8). They were all 1980 certification vehicles for California. Two vehicles are numbered D80–101C and D80–65C–1. Other vehicles include the durability cars for engine families CP–8L1, CP–8M1, CP–8T1, CP–5X1, and BP–6C1 (vehicle numbers were not provided by AMC). Acceptable Monte Carlo data were not submitted for families CP–8L1, CP–8M1, CP–8T1, and CP–5X1. Vehicle D80–101C and family BP–6C1 were not entered into the Monte Carlo because these particular emission control systems were not AMC's prime system and would have been expected to have poorer emissions due to the lack of start catalysts. Only vehicle D80–65C–1 was entered in the Monte Carlo.

Family BP–6C1 was equipped with a 151 CID engine and FBC/EGR/3W. The remaining vehicles had 258 CID, I6 engines with FBC/EGR/AIR/3W/OC. The catalyst systems were different between these 6 certification families. Family CP–5X1 and vehicle D80–65C–1 were also equipped with 3-way start catalysts.

The one vehicle in Monte Carlo had no factors applied to its emission test results as

* This is not to say that 50,000 mile emissions for an AIR System would be lower than 4,000 mile emissions. It does, however, indicate the emissions reduction from a given baseline with an AIR System.

data for improved systems did not exist. The entire AMC development effort apparently consisted of two vehicle tests (8 at 26) on a single prototype vehicle with two different axle ratios, which effectively precluded the development of any improvement factors.

AMC stated that AMC would like to market 50-state vehicles in 1981. Also, the 1980 California emission control system used on Vehicle D–80–65C–1 is the best AMC system for emission control. On this basis and on the basis of the failure of this single vehicle in the Monte Carlo, the existing data indicate that the 258, I6 engine family will not be able to meet the 1981 standards of 0.41 HC, 3.4 CO, 1.0 NO_x, unless a catalyst change is performed.

Some recent data from the 258 engine are shown in Table V–1.

The technical staff predicts that vehicles equipped with the 151 CID engine will be able to fully comply with the 1981 emission standards (without a catalyst change), based on analysis of GM vehicles using this engine. AMC utilizes deterioration factors in certification that were actually generated by General Motors (5 at page 189).

Table V–1.—*Results of 1980 AMC Certification Vehicles Which Have Completed Durability Testing*

Family engine	VIN	Engine	Projected 4K			Projected 50K		
			HC	CO	NO_x	HC	CO	NO_x
CP–5N1	D80–65C–1	258	0.23	2.40	0.92	0.32	3.93	0.95
CP–5X1	Not given by AMC....	[illegible]	0.33	3.83	0.70	0.32	3.10	[illegible]

AMC asserts that,

"Should the other major manufacturers demonstrate the technology to meet 3.4 CO standard in 1981 it would then follow that AM could be expected to possess this same level of technology by 1983. It would be unreasonable and inconsistent, however, to expect a vendor-dependent company such as AM to possess this technology in the same model year as the other manufacturers." [8 at 4]

The EPA technical staff finds AMC's assertion inconsistent with their recent certification to the 1980 emissions standards. By meeting the 1980 standards, for their 1980 model year vehicles, AMC has shown the ability to develop and adapt the technology to meet Federal HC and CO standards that went from 1.5 g/mi. and 15.0 g/mi. in 1979 to 0.41 g/mi. and 7.0 g/mi. in 1980. AMC does not state why it would be more difficult for them to meet the 1981 and 1982 standards in which only the CO standard is lowered, as AMC will still be able to certify at the 2.0 NO_x.

In regard to the 151 engine AMC is purchasing from General Motors for 1981, AMC asserts that,

"The major AM effort results in adapting the engine and the emission control system calibration to compensate for our particular vehicle configurations must by necessity be conducted after the engine family has successfully completed the 50,000 mile durability process and acceptable deterioration factors have been established." [8 at 33]

For 1980 certification of AMC's BP–6C1 engine family, which is also a 151 cu. in. engine purchased from GM, AMC was in the same position it will be in for 1981 certification. Durability testing was completed by GM, and AMC was only required to adapt that technology to 4,000 mile emission data vehicles. The 50,000 mile test on GM durability vehicle 0297 occurred in January 1979. On the basis of three AMC 4,000 mile emission data vehicles, AMC was issued a Certification of Conformity for engine family BP–6C1 on August 20, 1979, less than nine months after the completion of the applicable GM durability vehicle. This was accomplished even though both HC and CO standards were lowered.

In 1981 and 1982, only the CO standard will be lowered, and having had calibration development experience with the 151 cu. in. engine for 1980 model year certification, the EPA technical staff concludes that lead time constraints should not be any more of a factor for the 1981 model year than it was for the 1980 model year. In fact, AMC does not need to wait until GM runs the 50,000 mile durability data vehicle for them. AMC has experience with adapting the 151 CID GM technology for model year 1980, which should provide a data base from which an emission data vehicle calibration study can begin.

AMC could start an emission data vehicle calibration study as soon as GM starts the 1981 151 CID durability vehicle. This study could give AMC the necessary information about calibration change sensitivity that would be necessary to be able to start emission data vehicle calibration after GM's durability vehicle is finished. This would reduce the 9 month time it took AMC in 1980 to adapt the GM technology.

It also should be noted that AMC has experience in 1980 with the adaptation of technology which is similar to the technology that they will buy from GM for 1981. This is the closed loop 3-way catalyst system that AMC is getting from GM for 1980. AMC's 1980 model year experience with closed loop feedback fuel metering could again reduce the adaptation time to less than the 9 months it took them in 1980.

Therefore, even if one assumes that AMC will take as long as it did in 1980 to adapt GM's technoligy, sufficient lead time exists for this to be done for model year 1981. As the above paragraphs indicate, the 9 months may be a conservative estimate. In any case, AMC's contention of a two year lead time cannot be substantiated, based on their performance for model year 1980.

B. *Chrysler.—Vehicles in the Monte Carlo Analysis.* The vehicles contained in the Chrysler waiver application (Reference 9) which met the minimum criteria for entry into the Monte Carlo are shown in Table V–2. Only four total vehicles were rejected for use in the analysis for not using prime emission control systems. All four cars were not identical to any other vehicle entered into the analysis, and therefore, these four vehicles did not affect the pass/fail outcome of any engine family. Vehicle 325F could have been omitted as it was equipped with multiple point fuel injection, and it is highly unlikely considering the remaining lead time, that Chrysler could mass produce many different engine families with such a system, especially for model year 1981.

Special mention should be made of the notation "would fail in all cases" in Table V–2. Vehicles from the 1.7L family (CO47, CO51, CO65), the 225–1 family (169, CO55, 332, 524N, CO59, CO61, CO69R), and the 318–4 family (566H, CO36, CO21, CO22) were excluded from the analysis. However, no negative impact on Chrysler results from eliminating these vehicles from the analysis, since the 1.7L, the 225–1 (3.7L), and the 318–4 (5.2–4V) families all have been determined to not be able to meet the standards without a catalyst change.

Table V–2.—*Vehicles in Chrysler Waiver Application Meeting the Minimum Criteria for Entry Into Monte Carlo*

Engine	VIN[1]	entered in[2] Monte Carol	If Not entered—why?
1.7L	264M	X	
	266M	X	
	334Z	X	
	CO54[3]	X	
	CO585[3]	X	
	CO66[3]	X	
	CO47		Would fail in all cases.
	CO51		Would fail in all cases.
	CO65		Would fail in all cases.
2.6L	233	X	
	232	X	
	J–01–1	X	
	246	X	
	258	X	
225–1	166	X	
	BO18[3]	X	
	485	X	
	169		Would fail all cases.
	CO55[3]		Would fail all cases.
	332		Would fail all cases.
	311	X	
	537F	X	
	588	X	
	325F	X	
	524N		Would fail all cases.
	CO59[3]		Would fail all cases.
	CO61[3]		Would fail all cases.
	CO69R[3]		Would fail all cases.
	CO46R[3]	X	
	CO67[3]	X	
318–1	175H	X	
	694N	X	
	614N	X	

Table V–2.—*Vehicles in Chrysler Waiver Application Meeting the Minimum Criteria for Entry Into Monte Carlo*—Continued

Engine	VIN[1]	entered in[2] Monte Carol	If Not entered—why?
318–4	131H	X	
	566H		Would fail all cases.
	162H	X	
	CO36[3]		Would fail all cases.
	CO21[3]		Would fail all cases.
	CO22[3]		Would fail all cases.

[1] A group of vehicles that are single spaced are identical vehicles (i.e. vehicles 169 and CO55 are identical)-as nearly as can be determined. Consistent information regarding catalyst volume, loading, and Pt:Rh ratio was not presented by Chrysler. Vehicles separated by a dotted line vehicles 311, 537F, and 588 are not identical.
[2] "X" meaan entered.
[3] Certification car.

Pass/Fail Analysis for 1.7L Engines

All three prototype vehicles using the 1.7L engine failed in the Monte Carlo analysis until catalyst change and an improved catalyst were simulated. All but one of the vehicles pass in this case, thus the family is projected to pass a 3.4 CO standard with catalyst change.

It is unusual that the prototype vehicles used less catalyst volume than the certification vehicles and passed while the certification vehicles failed. This is explained by the probabilities of the 1980 model certification cars passing as shown below:

	Percent probability of passing		
	HC	CO	NOx
Car CO54	100	98	85
Car CO585	100	100	27
Car CO066	92	92	26

Apparently the vehicles in certification were calibrated differently than the prototypes, possibly due to the allowance of line-crossing by California. Data from six 1980 model year Chrysler certification vehicles were submitted. Three of the vehicles (CO47, CO51, and CO65) were not included in the Monte Carlo data due to poor emissions, and the other three vehicles (CO54,CO585, and CO66 which were entered) failed even with factors and catalyst change due to high *NOx* not CO, emissions. All six vehicles were equipped with catalysts of the volume projected by Chrysler for use in 1981, but no catalyst loading information was provided.

Vehicle 266M requires some special discussion here as the factor applied to all of these vehicles was for an increased rhodium (Rh) content in the catalyst. Car 266M was tested with a catalyst with a 6.7:1 platinum (Pt) to Rh ratio; however, the Pt content was reduced to account for the decreased Pt:Rh ratio (the typical Chrysler ratio of Pt:Rh is 10) and Rh content was held constant. The applied factor assumes a constant Pt level and an increase in Rh content to obtain the reduced Pt:Rh ratio of about 7:1. Thus an additional factor should have been applied to account for the reduced Pt content, but as part of the conservative nature of the analysis, such a factor was not applied.

As a margin of safety, Chrysler plans to increase the volume of the catalyst used on similar vehicles in 1981 certification. The catalysts planned for certification are a close coupled catalyst of 115 cubic inches of 3-way catalyst and 55 cubic inches of oxidation catalyst followed by an underfloor oxidation catalyst of 90 cubic inches (3 at Vol. I, Section V, p. D–2). This change was not simulated in the Monte Carlo analysis, thus making the analysis conservative.

Pass/Fail Analysis for 2.2L Engines

Chrysler did not submit acceptable durability data for this family.

Pass/Fail Analysis for 2.6L Engines

The 2.6L engine family included vehicles which were not equipped with 3-way catalysts. Because the Car to Car, DF, and Test to Test variabilities for NOx used in the Monte Carlo can be different for vehicles not using 3-way catalysts, the NOx probabilities for the vehicles which passed were hand calculated and included in the Part III Monte Carlo results. Vehicles which were affected include J–01–1 and 258. A more complete expalnation can be found in Section V–E which discusses Toyota's technical capabilities.

Of the five vehicles submitted by Chrysler, all were entered into the Monte Carlo, and two passed without catalyst change. They were cars J–01–1 and 258. This family is projected to pass based on car J–01–1. (Supported by the passing of car 258.) Car J–01–1 was substantially different from the other five vehicles in that a much reduced rear axle ratio was used, i.e.: 2.79:1 as opposed to 3.31:1 on the other 4 cars.

No factors were applied to the vehicles in the analysis. When a catalyst change was simulated, all five vehicles passed.

Chrysler's likelihood of passing certification is further increased in that they intend to increase the catalyst volume from a total of 85 cubic inches as used on these vehicles to 104 cubic inches in 1981 certification (3 at Volume I, Section V, p. D–2).

Pass/Fail Analysis for 3.7L (225 CID) Engines

Thirteen cars were considered in the analysis of the 225 CID engine family. Seven vehicles (listed in Table V–2) were not entered into the computer analysis and would fail all cases if entered. Of the remaining nine vehicles, none of these vehicles passed without factors and without catalyst change. In reality, car B018 has already passed the model year 1981 emission standards in certification. Its complete emission results are shown in Table V–3. When the 1981 standards of 0.41 HC, 3.4 CO, 1.0 NOx are compared to the projected 4,000 mile and 50,000 mile results of car B018, it can be seen that 50,000 mile NOx emissions are very close to the standard. That is why the car failed to pass the Monte Carlo analysis, *even though it could be certified for 1981.* This is an example of the conservatism of EPA's methodology.

With the catalyst improvement factor, car B018 passed. However since vehicles with larger, more heavily loaded catalysts failed, the 225 family was considered to fail with the catalyst improvement factor and without catalyst change. Other vehicles in the sample used catalysts substantially different than the ones used on car B018 as shown in Table V–4.

With catalyst change and no factor, again only vehicle B018 passed.

Table V–3.—*Certification Test Results of Vehicle B018*

	HC	CO	NOx	Emission control systems
Miles:				
0	0.26	2.2	0.72	FBC/AIR/EGR/ 3W/OC
5,000	0.18	1.6	0.86	
10,000	0.24	1.0	0.79	
15,000	0.34	2.0	0.68	
15,000	0.32	3.1	0.79	
20,000	0.23	2.3	0.84	
25,000	0.29	2.0	0.87	
30,000	0.24	2.5	1.10	
30,000	0.22	2.6	0.90	
35,000	0.18	2.1	0.91	
40,000	0.20	2.3	0.95	
45,000	0.23	3.4	1.00	
45,000	0.21	3.0	0.92	
50,000	0.27	2.4	0.93	
Deterioration:				
Factor	1.0	1.7	1.3	
Proj 4K	0.26	1.67	0.78	
Proj 50K	0.22	2.86	0.96	

Table V–4.—*Catalysts Used on Vehicles Analyzed (225 CID)*

	3W catalyst		Oxidation catalyst	
	Volume	Pt/Rh	Volume	Pt/Pd
VIN:				
524N	90	30/3	90	100/0
325F	135	10/1	.....	.....
166	90	150/15	152	50/0
169	135	100/15	141	75/0
311*	90	100/15	141	150/0
0	71	100/151	.....	.....
322	125	150/15	141	100/0
485	90	150/15	152	50/0
537F*	135	150/15	141	100/0
588	125	115/151	212	100/0
B0108*	90	150/15	152	100/0
C055*	135	100/15	141	75/0
C059*	90	150/15	141	150/0
C061*	90	100/15	141	50/0
C069*	125	150/15	90	75/0
C046R	90	150/15	141	75/0
C067	135	150/15	90	100/0

With catalyst change and factors, vehicles, B018, 311, and 537F passed. The fact that car 537F passed is important as this car most closely represents the vehicle Chrysler wants to build in 1981 (i.e. includes lock-up torque converter and large catalysts).

Pass/Fail Analysis for 318–2 Engines.—Three vehicles (all that were acceptable data) were entered into the statistical analysis. They are cars 175H, 694N, and 604N. Car 694N passed with the catalyst improvement factor and no catalyst change. Car 175H was similar and failed; however, it had a much reduced axle ratio (2.41 vs 2.7). On this basis the family was determined to pass a 3.4 CO standard. Car 604N had much reduced catalyst loadings as shown in Table V–5.

With catalyst change and no factors, still only car 694N passed. With both the catalyst

improvement factor and catalyst change, all the cars pass.

Pass/Fail Analysis for 318–4 Engines.—Two vehicles (131H, 162H) were submitted into the Monte Carlo analysis and an additional three cars (CO36, CO21, and CO22) were considered in the pass/fail analysis. These latter three cars would fail if they had been entered into the Monte Carlo data base.

No vehicle with a 318–4 passed either with or without factors and no catalyst change. Without factors and with catalyst change car 131H passed. The family was deemed to have failed; however, as other similar cars failed with higher catalyst loadings as shown in Table V–6.

Table V–5.—*Catalysts Used on 318–2 Vehicles*

VIN	Close-coupled 3W		Underfloor 3W		Underfloor OC	
	Vol	Load	Vol	Load	Vol	Load
175H	2X75	150:15	71	150:15	141	100:0
694N	2X75	150:15	71	150:15	141	100:0
604N	57	10:1				
	50	10:1			152	100:0

Table V–6

VIN	Close-coupled 3W		Underfloor 3W		Underfloor OC	
	Vol	Load	Vol	Load	Vol	Load
C036	2X75	150:15	71	150:15	141	100:0
C021	2X75	100:15	71	150:15	141	100:0
C022	2X75	150:15	71	150:15	141	75:0
131H	2X75	100:15	71	100:15	141	75:0
566H	2X75	150:15	71	0:15	141	100:100
162H	2X75	150:15	71	150:15	141	100:0

Table V–7.—*Vehicles in GM Waiver Application Meeting the Minimum Criteria for Entry Into Monte Carlo*

Engine	VIN	Catalyst*		Entered in Monte Carlo			If not entered—why?
		Vol	HN	P	or	M*	
98	Z–518	160	3256	P			Not prime system.
	Z–713A	171	3428/2961	M		X	
	Z–519	160	3264	P		X	
	Z–714	130	3401/2931	P		X	
	Z–714A	171	3451/2961	M		X	
	7T263	160	3218	P		X	
151	Z–520	160	3264	P		X	
	Z–521	160	3229	M			Not prime system.
	Z–522	160	3258	P			Not prime system.
	Z–523	160	3229	M			Not prime system.
	Z–524	160	3264	P		X	
	Z–525	160	3229	M		X	
	Z–620	160	3256	P		X	
	Z–621	160	3258	P		X	
	Z–625	192	3186/2874	M		X	
	Z–720	171	3428/2961	M		X	
	Z–721	171	3429/2962	M		X	
	Z–722	171	3452/2961	M		X	
	67506	100	Volvo prod	M			Not prime system.
	67510	160	3218	P		X	
173	Z–550	180	3229	M			Not prime system.
	Z–551	160	3256	P		X	
	Z–552	120	3246/3246	P		X	
	Z–553	155	3305/2846	M		X	
196	Z–741	171	3430/2962	M		X	
	Z–742A	171	3428/2961	M		X	
	Z–743A	130	3501/4063	P		X	
231	Z–640	150	3256	P		X	
	Z–641	160	3258	P		X	
	Z–643	250	3256/2576	P		X	
	Z–644	250	3256/2576	P		X	
	Z–645		3186/2874	M		X	
	Z–649	160	3293	P		X	
	66418	210	3166	M			Not prime system.

With the catalyst improvement factors and with catalyst change, cars 131H, and 162H passed. On that basis (two of six total cars), the family was considered to pass.

Pass/Fail Analysis for 318–EFM and Engines.—No acceptable durability data were submitted by Chrysler for either of these families.

C. General Motors

The prime emission control system planned for use by GM in 1981 and 1982 for 3.4 CO is FBC/EGR/AIR/ISC/3W/OC. Variations on this basic system by engine family for 1981 and 1982 were claimed by GM to be confidential. For a 7.0 CO standard in the same model years, GM would eliminate the oxidizing portion of the 3W + OC catalyst system (and replace the oxidizing portion with additional 3W catalyst—all at a constant noble metal loading and nearly constant total catalyst volume [4 at 71–72, also at 196 to 205]) and modify and/or delete the AIR injection system.

Table V–7 contains information about all vehicles submitted by GM which were candidates for Monte Carlo analysis. It should be recognized that vehicles with 3W only catalyst systems are not prime system for achieving 3.4 CO. The data from 3W only catalyst systems are not considered here when data are available for 3W + OC systems.

Pass/Fail Analysis for 98–2V FBC Engines.—Acceptable data for the Monte Carlo analysis were submitted by GM for six vehicles. One car (Z–518) was not entered into the Monte Carlo as it was not a prime system. Of the remaining five vehicles, three were prime systems for 3.4 CO (3W + OC) and two were prime systems for 7.0 CO (3W only). No factors were applied to any of the vehicles.

Both remaining vehicles with 3W only systems (Z–519 and 7T263) failed at 3.4 CO both with and without catalyst change. Car Z–714A passed with and without catalyst, and cars Z–714 and Z–713A passed only with catalyst change.

This family is projected to pass without factors and without catalyst change on the basis of vehicle Z–714A (and differences in emission control systems, e.g., different catalyst codes, between this car and the other cars). Since all three vehicles with the 3W + OC systems passed with catalyst change, this family is also projected to pass with catalyst change.

Pass/Fail Analysis for the 151–A FBC Engines.—A total of fourteen vehicles were submitted by GM that were adequate for Monte Carlo analysis. Four vehicles (Z–521, Z–522, Z–523, and 67506) were rejected as they were not prime systems. None of these vehicles used 3W + OC systems, and would not affect a pass/fail projection at 3.4 CO.

Only four of the remaining vehicles used 3W + OC systems.

Table V-7.—*Vehicles in GM Waiver Application Meeting the Minimum Criteria for Entry Into Monte Carlo—Continued*

Engine	VIN	Catalyst*		Entered in Monte Carlo			If not entered—why?
		Vol	HN	P	M	M*	
260	Z-536A	160	3293	P			Not prime system.
	Z-537	210	3267	M		X	
	Z-538	195	3246/3246	P		X	
	Z-633	250	3264/2576	P		X	
	Z-635	260	3279	P		X	
	Z-732	250	3395/2924	P		X	
301	Z-725	250	3394/2924	P		X	
305	Z-514	195	3246/3246	P			Cat. vol. much smaller than typical.
	Z-515	260	3263	P			Not prime system.
	Z-516	260	3263	P		X	
	Z-517	260	3263	P		X	
	Z-610	260	3263	P		X	
	Z-612	250	3256/2576	P		X	
	Z-613	192	3186/2874	M		X	
	Z-614	250	3256/2576	P		X	
	Z-615	192	3186/2874	M		X	
	Z-710	250	3374/2934	P		X	
	Z-711	250	3470/2934	P		X	
	Z-712	250	3395/2924	P		X	
	66313	120/260	3096/prod	M/P		X	
	66353A	210	3141	M		X	
	67326	160	3172	P		X	
	67327	174	3161/2707	M		X	
	67328	260	3172	P		X	
	67334A	174	67334A	M		X	
	67339	195	3246/3246	P		X	
	68306	160	3265	P		X	
	68331	120	3248	M		X	
	68332	250	3264/2576	P		X	
	67325	160/260	3062/prod	M/P		X	
350 Olds	Z-532	171	3186/2773	M			Not prime system.
	Z-533	210	3141	M			Not prime system.
	Z-534	260	3263	P		X	
	Z-535	260	3226	P		X	
	Z-539	195	3246/3246	P		X	
	Z-630	260	3279	P		X	
	Z-631	192	3186/2874	M		X	
	Z-634	250	3256/2576	P		X	
	Z-730	250	3407/2935	P		X	
	Z-731	250	3406/2934	P		X	
	Z-735	250	3407/2935	P		X	
	67410	260	3174	P		X	
350 Olds EFI	Z-760	250	3394/2925	P		X	
	Z-761	250	3395/2924	P		X	
350 Chev	65344	260	3032	P		X	
	66346A	120/260	3125/prod	M/P		X	
Other Vehicles Considered:	Z-512	160	3256	P		X	
	Z-513	180	3229	M		X	
	Z-649+	160	3293	P			Not prime system.
	Z-618	260	3263	P		X	

*The HN number is the GM catalyst code number. Different code numbers indicate different catalysts; however, identical code numbers do not necessarily represent identical catalysts. If the HN number is a single number, the vehicles uses a 3W only catalyst system. If the HN number is two numbers separated by a slash (/), the vehicle has a 3W + OC catalyst system. P means pellet, M means monolith.

No factors were applied to any vehicle in the 151 family. Vehicles Z–625 and Z–721 passed without catalyst change, and vehicles Z–620, Z–625, and Z–720 would pass with catalyst change. This family is projected to pass a 3.4 CO standard on the basis of vehicles Z–625 and Z–720. With catalyst change the family is again projected to pass a 3.4 CO standard as all four vehicles with 3W+OC systems pass. They are all unique vehicles and represent different engine families as indicated by the catalyst code numbers.

A 3W+OC pelleted oxidation catalyst system was not present in this sample.

Pass/Fail Analysis of 173–2V FBC Engines

Of the four acceptable vehicles in the 173 family, one (vehicle Z–550) was rejected from Monte Carlo as it was not a prime system. This vehicle and car Z–551 used 3W only catalyst systems and were not prime systems at 3.4 CO.

No factors were appllied to these vehicles. All vehicles failed without catalyst change. Both vehicles (Z–552 and Z–553) using the prime system passed 3.4 CO with catalyst change. Thus the family is projected to pass only with catalyst change.

Pass/Fail Analysis of 196–4V FBC Engines

A total of 3 vehicles were submitted by GM. All were included in the computer analysis, and all used different 3W+OC systems (and thus would be considered different engine families in certification). However, there is "no data" for the 196–4V engine since all three of these vehicles have 2-barrel carburetors.

No factors were applied to the three cars. Car Z–741 was projected to pass without a catalyst change, and cars Z–742A and Z–743A would pass with a catalyst change. Because data was not supplied for the 4-barrel carburetor, this is considered a "no data" case.

Pass/Fail Analysis for 231–2V FBC Engines

Data for seven vehicles with 231 engines were provided by GM. Vehicle Z–649 was not considered in this analysis as it was equipped with Throttle body fuel injection (TBFI).

Vehicle 66418 was not included in the Monte Carlo run as it was not a prime system. Of the remaining five cars, only three (Z–643, Z–644, and Z–645) used 3W+OC systems.

No factors were applied to any of the vehicles. At 3.4 CO, all the vehicles with 3W only catalyst systems failed without and with catalyst change. Also at 3.4 CO, all three vehicles with 3W+OC systems passed only with catalyst change.

Thus, this family is projected to fail without catalyst change and pass with catalyst change.

Pass/Fail Analysis of the 231–4V Engine

GM did not submit acceptable data for this family.

Pass/Fail Analysis of 260–2V FBC Engines

Acceptable data for input to Monte Carlo were provided for six vehicles in the 260 family. Vehicle Z–536A was not entered into the statistical portion of the analysis as it was not a prime system. Three of five remaining vehicles used 3W+OC systems (cars Z–538, Z–633, and Z–732). Improved catalyst factors were applied only to car Z–732.

Car Z–633 passed in all four cases. Cars Z–537, Z–538, and Z–635 passed with catalyst change and no factors. Car Z–732 passed only with factors and with catalyst change.

On the basis of car Z–633, this family is projected to pass without factors and without catalyst change. Since 2 of 3 cars using the prime 3.4 CO system (Z–633 and Z–538) passed without factors and with catalyst change and since both cars using the prime 7.0 CO system (Z–536A and Z–635) passed 3.4 CO without factors and with catalyst change, this family was deemed to pass this case. The remaining vehicle (Z–732) passed only with the catalyst improvement factor and catalyst change.

Pass/Fail Analysis of the 267–2V Engine

GM did not submit acceptable data for this family.

Pass/Fail Analysis for the 301–A Engine

GM provided data for only one vehicle which had a two barrel carburetor. It was entered into the Monte Carlo and a catalyst improvement factor was applied to vehicle Z–725. This car used the prime 1981 emission control system for 3.4 CO.

Car Z–725 passes with the catalyst improvement factors and without catalyst change. It also passes with and without the factors with catalyst change, but because it did not have a 4 barrel carburetor, these families are considered to have no data.

Pass/Fail Analysis for the 305–4V FBC Engines

GM submitted acceptable data on a total of twenty-three vehicle with 305–4V engines. Two vehicles (Z–514 and Z–515) were not entered into the Monte Carlo because vehicle Z–215 used a 3W only emission control system and would not affect a pass/fail analysis of the 3.4 CO standard, and vehicle Z–514 used a catalyst with a volume much smaller than typical for GM vehicles with this engine displacement.

Of the remaining twenty vehicles, eleven were equipped with 3W+OC systems (i.e. prime systems for 3.4 CO). These were vehicles Z–612, Z–614, Z–615, Z–710, Z–711, Z–712, 66313, 67327, 67339, 68332, and 67325. The improved catalyst factors were applied to vehicles Z–711 and Z–712.

Without catalyst change, vehicles Z–712 and 67327 passed the 3.4 standard. As indicated by the catalyst code numbers, there were no vehicles in this sample which would be in the same certification engine families as these two vehicles. All of the eleven vehicles with 3W+OC systems would pass with catalyst change except car Z–614.

Consequently this family is projected to pass with and without factors and without catalyst change and is projected to pass with and without factors and with catalyst change.

Pass/Fail Analysis of the Oldsmobile 350–4V FBC Engines

Acceptable data were received for a total of thirteen vehicles. Vehicle Z–533 was not entered into the computer analysis since it was not a prime system. Of the remaining dozen cars, seven were equipped with 3W+OC systems. They are cars Z–532, Z–539, Z–631, Z–634, Z–730, Z–731, and Z–735.

The catalyst improvement factors were applied to cars Z–730, Z–731, and Z–735. With neither factors nor catalyst change, vehicles Z–532, Z–634, and Z–735 pass the 3.4 CO standard. With catalyst change all seven vehicles with 3W+OC are projected to pass the 3.4 CO standard.

Different catalysts were used on all the vehicles with 3W+OC systems. Based on this and the success of cars Z–532, Z–634, and Z–735, vehicles using this engine are projected to be capable of passing certification at a 3.4 CO standard without additional technology and without catalyst change. Based on the success of this entire group of seven cars, vehicles using this engine are also projected to pass with catalyst change.

Pass/Fail Analysis of Oldsmobile 350-Multipoint (8-point) Fuel Injected Engines

Data were submitted by GM on two vehicles using the 350 Oldsmobile engine with Bendix multipoint fuel injection. These are cars for which no waiver was requested. Thus, these vehicles will not be discussed in detail. For the interested reader, however, both vehicles passed without catalyst change.

Pass/Fail Analysis of Chevrolet 350-4V FBC Engines

Data from both acceptable vehicles (65344 and 66346A) were included in the Monte Carlo analysis. Car 65344 was equipped with a 3W only catalyst system, and 66346A had a 3W+OC system.

No factors were applied to either vehicle. The prime vehicle for 3.4 CO (66346A) passed without catalyst change. The other vehicle failed without and with catalyst change.

The family was, therefore, considered to pass without factors or catalyst change.

Pass/Fail Analysis for the EF-P, EF-H, EF-M, EF-K, EF-J, EF-W, EF-N, EF-V, EF-Y, EF-X, EF-T, EF-E, EF-C, EF-U, and EF-O Engines

Because the data submitted from GM did not reflect the prime system for the engine family for which a waiver was sought, these families have been determined to be "no data" families.

D. British Leyland

Table V-8 lists the engines for which British Leyland is requesting CO waivers, and the corresponding emission control system being developed to meet the 3.4 CO standard. Table V-9 lists the vehicles considered in the pass/fail analysis.

Table V–8

Engine	Emission control system
120 cu. in	Carb. + one closed loop fuel injector/3W/ESA/HEI.
2.0 L	CLEFI/3W.
215. cu. in	CLEFI/3W/EGR.
258 cu. in	CLEFI/3W.
326 cu. in	CLEFI/3W/3W

Table V–9.—*Vehicles in British Leyland Waiver Application Meeting the Minimum Criteria for Entry Into Monte Carlo*

Engine	VIN	Catalyst	In Monte Carlo?	If not entered, why?
2.0L	TVC 51R	TWC/1903	Y	
	SHP 639R	EW23/39L–1/4/6	Y	
	BDU 988T	EW 23/39L–1/4/16.7	Y	
	BDU 987T	EW 23/39L–1/6/16.7	Y	
215 cu. in	JYF 230N	EW 23/39L–1/6/16.7	Y	
	JYF 229N	EW 23/39L–1/6/16.7	Y	
	VRW 408S	EW 23/39L–1/4/16.7	Y	
	VRW 411S	EW 23/39L–1/4/16.7	Y	
	CVC 845T	EW 23/39L–1/6/16.7	Y	
	CVC 844T	EW 23/39L–1/4/16.7	Y	
326 cu. in	BL–1		Y	

Pass/Fail Analysis for the 120 cu. in. Engines MGB).—British Leyland did not submit durability data for this engine.

Pass/Fail Analysis for the 2.0L Engines (TR7).—The 2.0L family is projected to pass with factors for an AIR system, without a catalyst change. This assessment is based on the results of vehicle TVC–51R.

Although TVC–51R was the only vehicle to pass with factors for an AIR system, without a catalyst change; it had a unique catalyst. The other vehicles considered in the pass/fail analysis for this family includes BDU 988T and BDU 987T. Both vehicles are considered to have failed all cases, although the Monte Carlo results show these vehicles as having passed with factors, without a catalyst change. The factor used in this case was for a switched AIR system with a clean-up oxidation catalyst. Because British Leyland claims it would be impossible to add an additional oxidation catalyst, due to insufficient room, this factor is not being used in this analysis, and the two vehicles are considered to have failed all cases. Vehicle SHP 639R also failed all cases, but its "L" Jetronic fuel injection system was of an early design that did not include an adaptive time constant, and therefore was judged as not having current emission control technology.

Because these latter three vehicles did not include the catalyst with which TVC 51R was equipped, and one of the three did not include a current design fuel injection system, the results of vehicle TVC 51R are, in the judgment of the EPA technical staff, representative of the 2.0 L engine's capabilities.

Pass/Fail Analysis for the 215 cu. in. Engines (TR8)

British Leyland submitted durability data from six vehicles for the 215 cu. in. engine. This family is projected to pass without factors, with a catalyst change. This assessment is based on the results of vehicles JYF 230N and JYF 229N, which passed without factors, with a catalyst change. These two vehicles and vehicle CVC 845T were equipped with catalyst EW 23/39L1/6/16.7. CVC 845T failed with a catalyst change, without factors, but two of the three vehicles with catalyst EW 23/39L–1/6/16.7 passed with just a catalyst change. Also, vehicle VRW 408S, which was equipped with a catalyst having a lower noble metal loading, also passed with only a catalyst change.

Vehicles CVC 844T, JYF 229N, JYF 230N and VRW 411S were run in the Monte Carlo in three different simulation cases, with differing vehicle identification numbers. *Case A*: no factors for vehicles CVC 844T, JYF 229N, JYF 230N, and VRW 411S. *Case B*: factors for AIR which included vehicles CVC 844T–1, JYF 229N–1, JYF 230N–1, and VRW 411S–1. *Case C*: factors for switched AIR and a clean-up catalyst, which included vehicles CVC 844T–2, JYF 229N–2, JYF 230N–2, and VRW 411S–2. Case C and its included vehicles should be disregarded, as they were not used in the pass/fail analysis for the 215 cu. in. engine.

Pass/Fail Analysis for the 258 cu. in. Engines (XJ6)

British Leyland did not submit durability data for this engine.

Pass Fail Analysis for the 326 cu. in. Engines (XJ12/XJS)

British Leyland only supplied durability data from one certification vehicle. Based on the results of vehicle BL–1, this family is projected to fail.

E. Toyota

Toyota has developed two emission control systems for four of its five engines. "The System A objective was to meet the 3.4 CO standard without particular regard to cost, available space . . . or other possible negative factors . . ." [14 at 10]. System B is Toyota's cost effective approach to meeting the 1981–82 standards. Toyota stated that "despite our strong expectations for these System B emission controls, prototype testing proved them inadequate in each case . . ." [14 at 10]. Toyota would use its System B to comply with a 7.0 CO standard.

Two of the Toyota engine families, the 88.6 and the A–8, did not use 3-way catalysts. The variabilities (Car to Car, Deterioration Factor, and Test to Test) used in the Monte Carlo analysis were inappropriate for cars which were *not* equipped with 3-way catalysts. The vehicles discussed in the pass/fail analyses for the aforementioned engine families were affected and consequently their probabilities were calculated with the variabilities shown below.

	NOx variabilities		
	Car-Car	DF	Test-Test
No catalyst change:			
3-way	0.047	0.313	0.067
No 3-way	0.237	0.105	0.175
Catalyst change:			
3-way	0.047	0.040	0.057
No 3-way	0.237	0.105	0.175

Note that the NOx probabilities tabulated in the Part III Monte Carlo results have been hand calculated for the vehicles affected. Only vehicles which passed all three pollutants were hand calculated. Those that failed would not be influenced by a new NOx probability since the new and correct probability would only be lower. Also, the 2-car and 3-car cases were omitted and only the 1-car case was examined.

Table V–10 lists the vehicles submitted by Toyota which included acceptable data for the Monte Carlo simulation. The following list indicates the System A and B control systems for each family.

Engine	System A	System B
88.6	AIR/OX/EGR/EM	PAIR/OX/EGR/EM
108	CL-AIR/OSC/3W/EM	CL-AIR/3W/EM
144/134	Switched CL-AIR/3W/OX/EM.	CL-AIR/3W/EM
168/156.4	CL-AIR/3WSC/3W/EGR/EM System A has a more precise ECU, higher EGR rate and catalyst differences.	CL-AIR/3WSC/3W/EM
A-8	System B with a catalyst change at 30,000 miles.	PAIR/EGR/OX

Table V–10.—*Vehicles in Toyota Waiver Application Meeting the Minimum Criteria for Entry Into Monte Carlo*

Engine	VIN	System	Catalyst	Entered in Monte Carlo?	If not entered—why?
88.6	36B–16	B	130V(W)	Y	
	36B–25–1	B	17RT(L)	Y	
	31B–36	B	130V(X)	Y	
	36B–40	B	130V(W)	Y	
	36B–92	B	130V(W)	Y	
108	TE31–42		351	N	Not current control system.
	177B–16		351	N	Not current control system.
	130B–24		351	N	Not current control system.
	353B–40–1	B	420AH	Y	
	353B–40–2	B	340ESN	Y	
144	TA40–19	B	387AT	Y	
	RT651–2	B	387AT	Y	
	RT651–1	A	386W, 387AT	Y	
134	306B–2	B	387A	Y	
	RT333–1	A	387A, 351	Y	
	187B–4–1	B	387A	Y	
	187B–4–2	A	387A, 351	Y	
156.4	MX–10	B	310A	Y	
	MX–302	B	310A	Y	
	147B–14	B	M	Y	
	147B–20	B	M, 310A	Y	
168	147B–37	A	M, 310A	Y	
	338B–16	A	M, 310A	Y	
	338B–12	A	M, 310A	Y	
A–8	70B–15	B	130V(W)	Y	
	61–1–1	B	385D	Y	
	61–1–2	B	130V(W)	Y	

Pass/Fail Analysis for the 88.6 cu. in. Engines.—This family is projected to pass without factors, with a catalyst change. This assessment is based on vehicle 31B–36, which passed with just a catalyst change.

The results of four remaining vehicles were as follows: Vehicle 36B–16 failed all four cases, but it did not have the same catalyst as 31B–36. Vehicles 36B–25–1, 36B–40, and 36B–92 failed *NOx*, not CO.

The results of vehicle 31B–36 are considered to be representative of this family's ability to certify because it included a unique catalyst and had its NOx control technology calibrated such that NOx control would be more effective than that on vehicles 36B–25–1 and 36B–40 and 36B–92. Also, vehicles 36B–25–1 and 36B–40 did not fail CO, with a catalyst change.

Pass/Fail Analysis for the 108 cu. in. Engines

This family was judged to have insufficient data.

Vehicles 353B–40–1 and 353–40–2 were the only vehicles Toyota submitted with current System B control systems. Vehicles TE31–42, 177B–16, and 130B–24 all included a Reactive Manifold, which is no longer a part of Toyota's current emission control systems.

Since no acceptable durability data was submitted for System A, this family was judged as having insufficient data.

Pass/Fail Analysis for the 144/134 cu. in. Engines

This family is projected to pass without factors and without a catalyst change. This assessment is based on vehicles RT–651–1, RT333–1, 187B–4–2, which were equipped with system A, and passed without factors and without a catalyst change.

Vehicles 187B–4–1, TA40–19 and RT651–2 were equipped with System B. Vehicle 187B–4–1 passed without factors and without a catalyst change. TA40–19 and RT651–2 passed with a catalyst change, with and without factors. Vehicle 306B–2 failed in all cases, but was also equipped with System B.

Pass/Fail Analysis for the 168/156.4 cu. in. Engines

This family is projected to pass with factors for an AIR system, without a catalyst change. Four of the seven vehicles included in the analysis, passed under the conditions mentioned.

Vehicle 338B–12 passed without factors, without a catalyst change and was equipped with System A. 147B–37 and 338B–16, which were equipped with System A, and 147B–20, which was equipped with System B, all passed with factors for AIR, without a catalyst change.

Vehicle 147B–14 passed without factors, with a catalyst change, and MX–10 passed with factors, with a catalyst change. MX–302 failed all cases. These three vehicles were equipped with System B.

Pass/Fail Analysis for the A–8 Engine

This family is projected to pass with factors for a start catalyst, without a catalyst change, and without factors, with a catalyst change.

Toyota only submitted data on three vehicles which would be acceptable for the Monte Carlo simulation. Since Toyota has not developed a System A for this engine, the three vehicles were equipped with System B. Vehicle 70B–15 and 61–1–2 were equipped with the same catalyst and both passed with factors for an AIR system, without a catalyst change, and also passed with a catalyst change, with and without factors. Vehicle 61–1–1 passed with factors and a catalyst change.

F. Volkswagen

Volkswagen has requested a CO waiver for its 97 cu. in. engine with feedback carburetion. VW stated that, for the same engine,

"The technology is available [to meet the 3.4 CO standard] in the use of the electronic fuel injection (K-jetronic) with a control and a single bed 3 way catalyst. This system is certifying in 1980 for California vehicles at HC, CO and NOx levels below 0.41, 3.4, and 1.0 respectively." [A at 3.1]

VW is requesting a CO waiver for cost reasons, claiming that the carbuetion system is significantly less costly than the fuel injection system.

Pass/Fail Analysis for the 97 cu. in. Engine

The 97 cu. in. engine with feedback fuel injection is projected to pass without factors, without a catalyst change, based on vehicle 283, which passed under the stated conditions. Additional data was not submitted for the fuel injected engine.

The 97 cu. in. engine with feedback carburetion is projected to fail all cases. This assessment is based on vehicles 439–734, 439–W–888, and 449–528. These vehicles did, or would fail all cases.

VW's position with respect to meeting 3.4 CO and being able to sell vehicles is unique compared to the other applicants. All the other applicants have maintained that effective control technology may not exist and have at least alluded to the consequences of not being able to meet the standards. VW's position is that effective control technology *does* exist (the fuel injection version), but they would rather not use it, and that the grant or denial of the waiver will not affect their sales anyway. Their waiver request might be categorized as being driven by convenience for VW, not necessity.

Table V–11.—*Vehicles in VW Waiver Application Meeting the Minimum Criteria for Entry Into Monte Carlo*

Engine		VIN	In Monte Carlo?	If not in Monte Carlo, why?
97	FI	283	Y	
97	FBC	439–734	N	Would fail in all cases.
		439–517	N	Not current control system.
		439–887	N	Not current control system.
		439–611	N	Not current control system.
		439–W–888	N	Would fail in all cases.
		449–528	Y	

VI. References for Sections I–V

1. *Automobile Emission Control—The Development Status, Trends, and Outlook as of December, 1976,* Environmental Protection Agency, April 1977.

2. Gerald F. Robertson, *A Study of Thermal Energy Conservation in Exhaust Pipes,* General Motors Research Laboratories, SAE Paper 790307, Feb-Mar, 1979.

3. *CO Waiver Application, Chrysler Corporation, Application for Waiver of the 1981–1982 Model Year Carbon Monoxide (CO) Standard of 3.4 Grams per Vehicle Mile for Passenger Cars,* July 3, 1979.

4. *Transcript of Proceedings—Environmental Protection Agency—In the Matter of: 1981 and 1982 Emission of Carbon Monoxide Waiver Hearings* dated July 9, 1979, by Acme Reporting Company.

5. *Transcript of Proceedings—Environmental Protection Agency—In the Matter of: 1981 and 1982* Emission *of Carbon Monoxide Waiver Hearings* dated July 10, 1979, by Acme Reporting Company.

6. *Transcript of Proceedings—Environmental Protection Agency—In the Matter of: 1981 and 1982 Emission of Carbon Monoxide Waiver Hearings* dated July 11, 1979, by Acme Reporting Company.

7. *Transcript of Proceedings—Environmental Protection Agency—In the Matter of: 1981 and 1982 Emission of Carbon Monoxide Waiver Hearings* dated July 12, 1979, by Acme Reporting Company.

8. *American Motors Corporation Application for Waiver of the 1981 and 1982 Carbon Monoxide Emission Standard,* July 3, 1979.

9. *CO Waiver Application, Chrysler Corporation, Application for Waiver of the 1981–1982 Model Year Carbon Monoxide (CO) Standard of 3.4 Grams per Vehicle Mile for Passenger Cars,* July 3, 1979.

10. *AB Volvo Submission In Connection With CO Waiver Hearings,* July, 1979.

11. *Response to Subpoena* dated June 29, 1979 of Environmental Protection Agency, Washington, D.C., by Saab-Scaia of America, Inc.

12. *Application for Waiver of the 1981 and 1982 CO Emission Standard for Light Duty Vehicles*—Volkswagen AG, July, 1979.

13. B. L. Cars, Ltd., *Application for a Waiver of 1981 and 1982 Carbon Monoxide Emission standards,* June, 1979.

14. Toyota Motor Co., *Request for Waiver Carbon Monoxide Standard Applicable to 1981 and 1982 Light Duty Vehicles.*

15. *Automobile Emission Control—The Current Status and Development Trends as of March 1976,* Environmental Protection Agency, April, 1976.

16. Engelhard Industries, July 9, 1979, *Response to the Environmental Protection Agency Subpoena* dated June 29, 1978, regarding the 1981 model year carbon monoxide standard.

17. **Federal Register,** Vol. 42, No. 124; Tuesday, June 28, 1977.

18. *Emissions From Combustion Engines and Their Control,* D. J. Patterson and N. A. Henein, 1972.

VII. Cost Analysis of Manufacturers' Emission Control Systems

EPA cost estimates presented here are based on the methodology described in cost Estimations for Emission Control Related Components/Systems and cost Methodology Description, LeRoy H. Lindgren, March 1978, prepared for EPA (Pub. #EPA–4601 3–78–002). Manufacturers' cost of estimates were generally rejected, for two reasons: a) lack of completeness and/or b) no explanation of methodology used to derive costs. The second (b) reason was by far the most important.

EPA developed a cost analysis for each manufacturer which accounted for all emission control-related hardware. Catalyst costing presented a special problem because of the problems presented in accounting for noble metals prices. As of July 1979 noble metal producers prices were inflated 170% over last year, according to American Metal Market/Metalworking News. However, it is doubtful that the automobile manufacturers pay this listed price. Chrysler and GM, for instance, have contracts with South African mines which could grant them a 23% discount of the published open-market price, according to Ward's Auto World, April 1978. Therefore, absent information from the manufacturers, this discount was used in the EPA methodology for determining noble metals costs in catalysts. Another problem related to noble metals costs, and costs in general, was predicting the effects of inflation between 1979 and 1981. An inflation factor of 12% per year was assumed for all costs labeled "1981 dollars" in the following pages (which translated into a calculation factor of 1.25 over 1981 costs labeled "1979 dollars").

Catalyst Change Cost Methodology

In order to estimate the cost of a catalyst change, the following procedure was followed.

1. The cost of the portion of the catalyst system that would be involved in a catalyst change was calculated. This is the cost of the pellets in a pelleted catalyst like GM's, and the cost of the entire catalyst system for monolithic catalysts. The technology exists to change just the pellets for pelletized catalysts, but for monolithic catalysts it appears that the approach taken toward a catalyst change would be to remove the entire catalyst system (container and catalyst) and replace the entire unit.

2. Since it is not known exactly how the cost for the replacement unit would be handled, the catalyst change costs were estimated as a range. The lower value of the range was obtained by assuming that the catalyst cost would equal the RPE cost, with no charge for labor. This is considered a lower bound on the cost. The upper value of the range was obtained by assuming that the replacement catalyst could be costed as a typical replacement part, and that the replacement part/RPE ratio was 3/1. In addition an installation labor cost of $10.00 for pellets and $20.00 for monoliths was assumed.

3. The above calculations were made for each engine family for which the technological capability analysis indicated that a catalyst change would be needed. Next, the catalyst change costs were sales-weighted to arrive at a range of per-vehicle catalyst change costs. These values are presented on the summary tables.

The table indicates that the cost impact of a catalyst change can vary substantially between manufacturers especially if a manufacturer who utilizes pellet catalysts and has a small number of families needing a catalyst change (GM) is compared to a manufacturer using monoliths, a large number of which need to be replaced to meet the standards (Chrysler).

How to allocate this per-vehicle catalyst change cost is not obvious, especially when one considers the impact on vehicle first cost. Since it is not clear how this cost would affect the first cost of the vehicle (the record is silent on this point) EPA considered the use of a range. One end of the range could be obtained by assuming that the catalyst change cost will not affect the vehicle first cost, and the other end of the range could be obtained by adding the catalyst change cost impact to the emission control system cost for the 1981 3.4 CO system. Because it was decided that the catalyst change would more likely be added into the first cost (e.g., July 19, 1979 transcript at pp. 127–135), the cost is also reflected in that manner in the table.

Cost of Compliance with 3.4 CO vs. 7.0 CO—EPA Estimates

The 1981 system costs listed below are described in 1979 dollars and 1981 dollars. (1981 dollar calculation accounts for 12% per year inflation, or a factor of 1.25 over 1979 costs.)

Table VII–1.—*Cost Increase for 3.4 vs. 7—EPA Estimates* [1]

Manufacturer	1979	1981
Chrysler	$344 to $702.	$430 to $878.
GM	$41 to $45	$52 to $56.
AMC [2]	$0	$0.
VW	$165	$207.
Toyota	$59 to $115	$73 to $143.
BL	$101 to $180.	$126 to $225.

[1] Includes catalyst changes where necessary to meet 3.4.
[2] Catalyst change impact on AMC no computed.

Table VII–2.—*3.4 vs. 7.0 EPA Cost Estimates*

[Assuming no catalyst change]

Manufacturer	1979
Chrysler	$14
GM	40
AMC	0
VW	165
Toyota	4
BL	0

Cost—The Manufacturers' Estimates: During the CO waiver hearings in Washington, D.C. on July 9th to 12th, EPA requested additional cost information from the manufacturers. The cost breakdown by emission component was declared confidential by most automobile manufacturers. For the most part, cost is in 1979 dollars, and is the total change in retail price per vehicle, or the retail change in price to modify the component to meet the 1981 standard of 3.4 grams per mile.

Some manufacturers have included in their total price the cost of some non-emission control components. This accounts for the large variety in total cost.

From these manufacturers' cost estimates the price range for emission control components is as follows:

Component	Minimum	Maximum
Electronic control unit (ECU)	$112	$125
Air injection system	64	112
EGR modification	8	133
Start-up catalyst	90	130
Catalyst (3W + OC) modification	30	186
Catalyst	76	287

This range of costs does not include a price estimate from each manufacturer but does include all estimates EPA received.

Table VII–3.—*Manufacturers' Estimates of Total Emission Control Cost and Change in Cost*

[In 1979 dollars]

	Chrysler [1]	GM	AMC	VW	Toyota	British Leyland
Total cost estimate to meet 3.4 standard	700	355	No data	Conf	Conf	Conf.
Decrease in cost if 7.0 standard were met	250	30–40	No data	225	Conf	Conf.

Conf = Confidential information.
[1] $700 includes $250 for catalyst change, the amount saved at 7.0 CO.
The data in this table is all available from the public hearings, GM on July 9, Chrysler on July 10, and VW on July 12, 1979.

VIII. Driveability and Fuel Economy

Driveability and fuel economy are specific criteria that are involved in the evaluation of technical feasibility. Each issue will be discussed separately, but it should be pointed out that the record is relatively sparse on these issues, compared to the issues of meeting the standards and the associated cost impacts.

Driveability

The subject of driveability and the data that would be considered as a basis to make a reasonably thorough technical evaluation were discussed by EPA in the waiver application guidelines. Unfortunately none of the applicants complied fully with the guidelines in the driveability area and the applicants themselves, therefore, have precluded EPA from considering the subject in as much detail as was originally considered appropriate, as indicated by the guidelines. It can be concluded that the applicants may not have considered the driveability criterion to be one that buttressed their case for a wavier, since so little was contained in the applications.

General Motors, whose application was essentially absent a substantive driveability discussion, was asked about the issue at the public hearing. The entire discussion can be found on page 182 of the July 9, 1979 transcript. GM stated: "We assume that we will be able to get good driveability with either standard."

The major discussion of driveability by Chrysler is found in the July 10, transcript starting on about page 72. However, the discussion centers around the attempt by Chrysler to explain the data which showed very low CO (less than 3.4) and good driveability (higher than Chrysler's goals), not in making any sort of detailed argument on any relationship between driveability at 3.4 vs. 7.0 CO. Further testimony is in the July 10 transcript beginning at page 97. This discussion involves near wide open throttle impacts of enrichment, power to weight ratio, etc., but again does not constitute a record which would allow EPA to make a distinction between 3.4 CO and 7.0 CO in terms of driveability or more importantly, customer acceptance.

The driveability discussion by AMC can be found starting on page 178 of the July 10 transcript. However, the discussion is not quantitative with respect to driveability, it is a discussion of balancing emissions, driveability, fuel economy, etc.

VW did not make a major issue out of driveability.

British Leyland also did not make driveability an issue in their CO request.

Toyota provided numerical driveability data on several different vehicles, some of which met Toyota's goals and some of which did not. However, Toyota did not describe the relationship between their driveability index and any measure of in-use consumer satisfaction or dissatisfaction. The driveability with the System A packages was in some cases better than for the System B packages (e.g., 3T–C) which does not support a trend toward reduced driveability performance at lower CO levels.

Summary—Driveability

It is clear that driveability will not be the major criterion that will determine the technical feasibility of 3.4 CO vs. 7.0 CO. The applicants did not stress the subject to any great extent, and did not comply with the guidelines on driveability. An assessment of the opinions of the applicants (except GM) seems to be that they think that driveability may be impacted negatively, but they didn't adduce any sort of data or analysis to make that case.

EPA staff looked to the technical literature in an attempt to increase EPA's understanding in this area, absent the magnitude of data that would have been needed to do a detailed study.

Two Society of Automotive Engineers papers and a Technical Report were studied. These are referred to as Reference DR–1, DR–2, and DR–3.

The abstract from Reference DR–1 is reproduced below.

"The effects of fuels having atypical distillation characteristics on the driveability, fuel economy, and emissions of vehicles equipped with a variety of power plants were studied. The power plants included conventional, stratified charge, port injected, and lean-burn engines. The atypical distillation fuels reflect the effect of removing varying amounts of mid-range or front-end blending components from a typical commercial gasoline.

"An index system was developed which allows a comparison of fuel effects across a fleet of vehicles differing substantially in terms of driveability, fuel economy, and emissions. Using this index system, the fleet average results show that emissions and fuel economy as well as driveability are depreciated with the extreme atypical fuels and that improved driveability can result in improved emissions and fuel economy."

Note that improved driveability was found to *reduce* emissions, not increase them.

The abstract from reference DR–2 is also reproduced below.

"Fuel volatility and cold/hot engine driveability relationships were evaluated in six 1976/1977 model cars representing conventional carburetor and advanced type fuel metering systems. The program objective was to provide guidance for engine modifications to take advantage of fuel benefits or to overcome performance deficiencies. There were large variations among cars in the maximum volatility tolerance relative to vapor lock during summer, hot engine operation, with a fuel-injected and a new design carburetor system tolerating gasoline volatility levels in excess of normal maximum summer levels. Similarly, cold engine start and driveaway performance at low and intermediate ambient conditions varied widely.

"Fuel-injected cars showed the best performance and least sensitivity to gasoline volatility changes. Performance differences among all cars with a specific fuel were significantly greater than differences resulting from typical variations of fuel volatility for individual cars. This shows that fuel systems can be designed to provide good overall driveability performance and wide tolerance in fuel volatility, permitting greater flexibility to produce unleaded gasoline."

Note that advanced fuel management systems showed good driveability. It is expected that the fuel management systems on most 1981 models will be an improvement over today's systems.

Reference DR–3 was studied to see if there was any relationship between driveability and CO emissions for vehicles tuned to manufacturer's specifications. No simple relationship was found, although it should be pointed out that the vehicle that had the lowest CO emissions, 2.04 CO, had better driveability than all but one of the 22 vehicles studied.

Therefore EPA concludes that the driveability impact of 3.4 CO vs. 7.0 CO, based on information made available by the applicants and other information, is such that any difference in driveability will not be of such a magnitude to make 3.4 CO technically infeasible on the basis of driveability alone.

Reference DR–1: *Atypical Fuel Volatility Effects on Driveability, Emissions, and Fuel Economy of Stratified Charge and Conventionally Powered Vehicles*, by J. H. Baudino and L. C. Copeland, SAE Paper 780610.

Reference DR–2: *Fuel Volatility Effects on Driveability of Vehicles Equipped with Current and Advanced Fuel Management Systems*, by C. R. Morgan and C. N. Smith, SAE Paper 780622.

Reference DR–3: *Light Duty Vehicle Driveability Investigation*, by H. A. Toulmin, EPA Report # EPA–460/3–78–012, December, 1978.

Fuel Economy

The issue of fuel economy is like the driveability issue in some respects and different in others.

Like driveability, fuel economy does not appear to be a criterion upon which the issue of technological feasibility will pivot, primarily due to the lack of emphasis placed on the issue by the applicants.

Unlike driveability, which tends to be a subjective (although sometimes quantified) subject the criteria for which varies from company to company, the measure of fuel economy is consistent across manufacturers due in large part to the fuel economy standards which each manufacturer must meet. Each manufacturer must meet a sales-weighted fuel economy standard of 22 miles per gallon for 1981 and 24 miles per gallon for 1982, the years under consideration for the CO waiver decision. Here, it would appear, is a decision criterion that EPA would have had to consider carefully if a manufacturer had claimed that meeting the 3.4 CO standard precluded meeting the fuel economy standards, while meeting 7.0 CO would allow the fuel economy standard to be met. *However, no applicant claimed that the 3.4 CO standard precluded that applicant from meeting the applicable fuel economy standard for either 1981 or 1982. Furthermore,*

no applicant indicated that a waiver to 7.0 CO would allow the fuel economy standards to be met.

Therefore, as one might expect, the record is not replete with data, arguments, or analyses that project the fuel economy difference between 3.4 CO and 7.0 CO.

An example of the treatment of the fuel economy by GM in their testimony can be found in the July 9, 1979 transcript starting at page 181. GM was asked if the additional oxidation catalyst needed for 3.4 CO caused a fuel economy penalty due to increased backpressure. GM said "No." When asked if the deletion of the air pump (a move toward 7.0 CO) would improve fuel economy, GM said that they looked for the effect in engineering tests using the EPA procedure but could not find a measurable difference.

The subject of fuel economy was not emphasized in Chrysler's oral testimony [July 10, 1979 transcript, pp. 62–155], or in their application.

AMC discussed fuel economy [July 10, 1979 transcript, p. 178], but only in the context of their opinion that the 1980 and beyond fuel economy standards were a formidable challenge and that driveability, producibility, and fuel economy need to be balanced, not a specific discussion.

The fuel economy issue with respect to VW is somewhat unique. Starting in the July 12, 1979 transcript at page 44, VW tries to explain the fuel economy benefits of the waiver, as seen by VW. VW tried to maintain that the cheaper carburetor system would allow them to make other vehicle (non-engine) improvements in fuel economy. However, the testimony shows [e.g., July 12 transcript at 47] that the non-engine fuel economy improvements represent a marketing, not technical issue and more importantly from the point of view of the waiver, apparently have nothing to do with 7.0 CO vs. 3.4 CO at all. It should also be noted that VW is not in any particular trouble with respect to fuel economy since they testified [July 12 transcript at 48] that they already now have fuel economy performance better than that required by the 1985 fuel economy standards (the most stringent ones).

Although Toyota discussed the subject of fuel economy somewhat more than the other applicants [e.g., July 9 transcript at 13], their claims vary—5% as their estimate and 2% to 3% as the difference between their system "A" and system "B".

In more detailed questioning [July 9 transcript at 27] Toyota indicated that they felt the fuel economy loss they forecast would be attributable to the air pump and increased backpressure. It should be noted that GM was asked specifically about these two potential fuel economy influencing factors (discussed in the GM discussion, above), and GM said they foresaw no penalty due to backpressure and could not measure any difference due to the presence or absence of the air pump. This leaves the record somewhat contradictory on this point, and tends to reduce the weight that EPA can put on Toyota's forecasts. Further discussion [July 9 transcript at 29–30] indicates that other factors may reduce even Toyota's projected loss. Toyota also did not make any claims of the 3.4 or the 7.0 CO emission standards affecting their capability to meet the fuel economy standards.

British Leyland's position on fuel economy is clouded by the lack of a firmly defined basis for each engine family from which different percent claims can be evaluated. The 5% to 10% fuel consumption *penalty* [July 10 transcript at 6], the 39% and 19% fuel consumption *improvement*, the 15% to 20% increase in fuel economy [July 10 transcript at 7], the comparison with 1979 of 4% to 28% improvement [July 10 transcript at 8], all tend to make the fuel economy issue for BL somewhat muddled, which is to say their claimed losses may be losses or they may be just lesser amounts of a larger overall gain.

In further testimony [July 10 transcript at 16], BL apparently arbitrarily changes the previously quoted 15% to 20% improvement to a 10% to 15% improvement.

In BL's Supplementary Report (July, 1979) in which BL replies to questions propounded to them by EPA, further fuel economy data is provided only for the XJ6 and XJ12 sedan models. Apparently the major issue raised by BL is the issue of whether or not the new cylinder head will be available for 1982 for the XJ12. BL did not provide data which would allow EPA to evaluate the influence of the new cylinder head on CO emissions. However, regardless of the CO standard, BL's own data indicates that a fuel economy *gain* will be achieved in 1981, compared to 1979.

In addition, BL did not claim or show that the 3.4 CO standard would preclude them from meeting the fuel economy standards.

Fuel Economy—Summary

Although the subject of vehicle fuel economy and the improvements in vehicle fuel economy that are required by the future fuel economy standards are important national issues, the record before EPA does not lend itself to a determination that the fuel economy performance at 3.4 CO vs. 7.0 CO will be of a direction or magnitude that would affect the determination of technological feasibility for these CO waiver proceedings.

Appendix B—Summary of Public Health and Air Quality Analyses as Related to Light Duty Vehicle CO Waiver Applications

Review of CO Air Quality and Health Effects Data

Data concerning the effects of a two year wavier of the light-duty vehicle (LDV) carbon monoxide (CO) emission standard have been obtained from various sources. These sources include: EPA's Office of Air Quality Planning and Standards (OAQPS); EPA's Office of Mobile Source Air Pollution Control (OMSAPC); Ford Motor Company; General Motors; and Chrysler. The data presented here consider the effects on air quality and public health of waiving the Congressionally mandated 1981 LDV CO emission standard of 3.4 grams/mile to 7.0 grams/mile for the 1981 and 1982 model years.

In our consideration of public health issues for this waiver request, we have assumed that the current EPA National Ambient Air Quality Standards (NAAQS) for CO of 35 ppm for a one-hour average and 9 ppm for an eight-hour average determine air quality levels adequate to protect public health. The NAAQS CO standard is designed to protect public health. The effect of a CO waiver on ambient air quality will thus also be considered in this paper as determining the effect of a CO waiver on public health.

This report will serve as a review of the air quality data presented in manufacturers' CO waiver submissions to EPA as well as the results of several of EPA's own air quality studies.

1. EPA—OAQPS Analysis

OAQPS has performed four successive analyses of the air quality impacts of waiving the 3.4 gram/mile LDV CO emission standard.[1,2,3,4] These analyses used rollback models to predict the differences in air quality for future years in various Air Quality Control Regions (AQCR's) as a result of different CO emission standards. Neither of the first two of these analyses considered the impact of a two year waiver but considered *either* a 3.4 gram/mile *or* a 7.0 gram/mile CO standard for 1981 and later years. This discussion will deal only with the data contained in the last of these four analyses as it is the most comprehensive in that it deals with the effects of a two year waiver and predicts the air quality effects on a year to year basis. This analyses includes scenarios combining three possible emission control system penetration rates, three emission rates, and three possible in-use deterioration rates. A total of 186 unique emissions scenarios for CO were analyzed and air quality projections were made for 19 AQCR's for the years 1981 through 1995. Specific details and assumptions made in the OAQPS analysis include the following:

(a) The analysis was done for 19 AQCR's. Criteria for choosing the 19 AQCR's were that appropriate CO data were available, the AQCR's had some of the most severe CO problems, the AQCR's were not in California or at high altitude where different emission rates would be necessary, and these AQCR's had been used frequently in the past by OAQPS. The 19 AQCR's are:

Birmingham, North Alaska, Clark-Mohave, Phoenix-Tucson, Hartford-New Haven, NY-NJ-Conn., Philadelphia, National Capitol, E. Washington-N. Idaho, Chicago, Indianapolis, Kansas City, Baltimore, Boston, Minneapolis-St. Paul, Central New York, Portland, S.W. Pennsylvania, Puget Sound.

(b) OAQPS's Linear Rollback Model was used to predict the reduction in ambient CO concentrations, the number of AQCR's above the 9 ppm, 8-hour NAAQS, and the total number of 9 ppm, 8-hour CO NAAQS violations in the 19 AQCR's in 1981 through 1995.

(c) The 186 CO emissions scenarios are those used in the March 9, 1979 memo from Charles L. Gray to Robert E. Neligan.[5]

(d) One half of the 186 scenarios assumed the following CO emission standards:

1977–79—15.0 grams/mile
1980—7.0 grams/mile
1981–95—3.4 grams/mile

The other half of the 186 scenarios assumed the following:

1977–79—15.0 grams/mile
1980–82—7.0 grams/mile
1983–95—3.4 grams/mile

(e) Each scenario assumed one of three possible generic emission control system

penetration rates. The resulting possibilities are:

(1) 100% 3-way plus oxidation catalyst systems (possible system for 3.4 grams/mile CO and 1.0 grams/mile NO_x).

(2) 100% 3-way catalyst systems (possible system for 7.0 grams/mile CO and 1.0 gram/mile NO_x).

(3) 10% 3-way catalyst systems, 80% 3-way plus oxidation catalyst systems, and 10% oxidation catalyst plus air pump systems (possible systems for 3.4 grams/mile CO and 1.0 gram/mile NO_x).

(f) Each scenario assumed one of three *certification* deterioration factors (DF's). The DF values possible were 1.0, 1.5, and 2.0 and the DF value chosen determined the CO emission level of new (zero mile) vehicles. Certification DF's are 50,000 mile emission levels of prototype vehicles (which must meet the emission standards) divided by 4000 mile emission levels. These DF's are then used to determine what emission levels new (zero mile) vehicles must meet.

(g) For each exhaust treatment system each of three possible *in-use* deterioration rates is applied. The primary deterioration rate is that reported by EPA in Table I–1 of its "Mobile Source Emission Factors" document and referred to as "AP–42." The other two deterioration rates for which scenarios are calculated are the "AP–42" rate divided by two and a zero deterioration rate.

(h) A one percent growth rate compounded annually from mobile source CO was assumed to result from increased vehicle miles traveled (VMT) for each AQCR.

(i) Stationary source CO emissions were projected to grow at a rate of 3.2 percent compounded annually.

(j) The CO base year concentration or "design value" was selected to be the highest second highest 8-hour concentration from the period 1974 through 1976. A background concentration of one ppm was also assumed for each region.

(k) The 1976 base year emissions inventories were taken from the EPA National Emissions Data System (NEDS) with suitable adjustments made to it to make it applicable for current mobile source emissions. Stationary source CO emissions from NEDS are included under electric generation, industrial, or miscellaneous sources.

(l) A stationary source contribution factor of less than 1.0 is used for each CO stationary source category. These factors account for the fact that CO "hot spots" are typically located in areas of high traffic density which are not usually associated with significant stationary sources of CO. CO stationary source contribution factors of 0.0 for power plants, 0.1 for industrial sources, and 0.2 for area sources were selected after considering the results from dispersion models for power plants and other industries, and review of the relationship between traffic density and CO levels in several situations.

(m) Control technology assumptions for stationary source CO control used in the OAQPS analysis are those described in the Three Agency Study.[6]

For each scenario the following projections are calculated for the years 1981 through 1995.

(a) The highest second highest 8-hour concentration of CO for each AQCR.

(b) The number of violations of the 9 ppm, 8-hour CO NAAQS for each AQCR.

(c) The average percent reduction in the highest second highest 8-hour CO concentration for the 19 AQCR's in 1981 through 1995 from the average 1976 concentration.

(d) the number of the 19 AQCR's in violation of the 8-hour CO NAAQS.

(e) The sum of the total number of 8-hour CO NAAQS violations projected to occur in the 19 AQCR's.

As only a limited amount of AQCR's are used in these projections, they must be viewed carefully. The data presented in Table 1 and Reference 4 are the results of projecting either a 3.4 or 7.0 gram/mile CO LDV emissions standard for the years 1981 and 1982 and then a 3.4 gram/mile CO LDV emission standard for the succeeding years. Within the constraints of these projections, both the average percent reduction in the highest second highest 8-hour CO concentration for the 19 AQCR's and the sum of the total number of 8-hour CO NAAQS violations in the 19 AQCR's are representative of what air quality trends that one could expect to see as a result of a two year CO waiver. The number of AQCR's predicted to show eight-hour NAAQS violations also serves as a comparison of the scenarios in the OAQPS data. Two scenarios have been chosen for comparison of the effects of the waiver on the above mentioned parameters.

These scenarios as summarized in Table 1 were chosen to represent first a possible reasonable assumption of what systems and deteriorations might be expected for vehicles meeting 3.4 or 7.0 grams per mile standards and second, what might be considered to be a "worst case" comparison looking for maximum differences between the two (but excluding the zero deterioration rate scenarios which although they showed greater improvements in air quality, were judged to be less probable). In 1985, with a CO waiver across the board, this analysis indicates that from 4 percent to over 30 percent more violations of the eight-hour CO NAAQS could occur in the 19 AQCR's analyzed.

Table 1.—*Air Quality Projections*

Scenario	1981	1982	1983	1984	1985
Nominal case					
Waiver (a):					
(e)	19	25	30	36	41
(f)	16	15	14	12	12
(g)	660	530	410	310	230
Standard	7.0	7.0	3.4	3.4	3.4
No Waiver (b):					
(e)	20	25	31	36	41
(f)	16	15	14	12	12
(g)	650	520	400	300	220
Standard	3.4	3.4	3.4	3.4	3.4
Possible maximum difference case					
Waiver (c):					
(e)	19	24	30	35	40
(f)	16	16	14	12	12
(g)	660	540	420	320	240
Standard	7.0	7.0	3.4	3.4	3.4
No Waiver (d):					
(e)	20	26	32	38	44
(f)	16	15	14	12	11
(g)	640	510	380	270	180
Standard	3.4	3.4	3.4	3.4	3.4

(a) 100% 3-way catalyst system, AP–42 deterioration rates, certification DF = 1.5.

(b) 100% 3-way plus oxidation catalyst systems, AP–42 deterioration rates, certification DF = 1.5.

(c) 100% 3-way catalyst systems, AP–42 deterioration rates, certification DF = 1.0.

(d) 100% 3-way plus oxidation catalyst systems, AP–42/2 deterioration rates, certification DF = 2.0.

(e) The projected average percent reductions of the highest second highest CO reading over the 19 AQCR's.

(f) The number of the 19 original AQCR's predicted to show 8-hour NAAQS violation.

(g) The total number of 8-hour CO NAAQS violations in the 19 AQCR's.

2. SRI–EPA CO "Hot Spot" Report

The Atmospheric Science Center of SRI International has in preparation for EPA a draft report entitled "Analysis of Pollutant and Meteorological Data Collected in the Vincinity of Carbon Monoxide 'Hot Spots.'" The SRI research program currently has the following objectives:

a. Identify the contribution of carbon monoxide (CO) and hydrocarbon (HC) emissions from local sources versus the contribution from regional sources, as determined by the total concentrations measured around urban roadways in areas where concentrations are greatest (i.e., "hot spots").

b. Estimate the percentage of vehicles in different operating categories—e.g., hot start, cold start, and stabilized, as well as traffic mix, volume, speed, and idletime data.

The analysis in the draft report addresses only the first objective. The other objective will be dealt with in another report.

For this study four cities (San Jose, Seattle, Phoenix, and Chicago) were chosen to represent a broad range of climatological areas and different vehicle operating conditions. The area chosen for HC and CO sampling within each city was also selected to provide diverse conditions. The San Jose site was in the vicinity of a congested suburban intersection with considerable commercial development in the immediate area. The Seattle and Chicago sites were in heavily congested downtown areas. The Phoenix site was near numerous government buildings and provided data from an area where there is a simultaneous emptying of many office buildings. The sites were also chosen to be sites expected to show "hot spot" or high CO levels from vehicle traffic. The sites picked in Seattle, Phoenix, and Chicago were ones known to have previously violated the NAAQS. Preliminary measurements at the San Jose site showed that high CO levels were also present at that location.

Within each site area the researchers wished to determine what fraction of the ambient CO level was from the surrounding area and how much from local (motor vehicle) sources. To do this ten monitors were placed at various locations within each site. Some were placed upwind, on tall buildings, or set back from local streets. These monitors would represent the areawide or background concentrations. Other monitors were placed closer to the local sources so that the street level or local source contribution could be determined. The area monitors could, even though they were placed well away from the local monitors, still be influenced by local sources. To

minimize this effect, the background concentration was chosen to be the lowest of the measured values of the area monitors.

The report presents, at great length, all of the data for both CO and HC at each of the ten monitors in each of the four sites. These data are also presented in terms of one- and eight-hour CO and HC averages for each site.

The San Jose site shows ten violations in seven days of the 9 ppm, eight-hour CO NAAQS. All of the readings resulting in violations occurred at monitors downwind of the intersection during light wind (2.1 m/s ave.) conditions. The local contribution to ambient CO levels during periods when the CO concentration was above 9 ppm (the eight-hour CO NAAQS) ranged from 62 to 98 percent and averaged 80 percent.

The Seattle site had five eight-hour CO NAAQS violations in the seven day period. Three of these violations were similar to the San Jose violations with relatively high CO concentrations being seen at all the local monitors. The other two violations were more widespread with high CO concentrations at all local and two of four background monitors. This indicates that these high CO concentrations were widespread and not restricted to the immediate study area or to "hot spots." The authors point out that these two violations occurred following heavy traffic volume over a fairly wide area and this probably accounts for the high background levels.

Four eight-hour CO NAAQS violations occurred in the seven days of sampling at Phoenix. They all occurred during eight-hour periods ending at about one to three a.m. During NAAQS violations local CO contributions ranged from 18 to 59 percent with a 35 percent average. This is a relatively small amount. The authors feel that the high night time and low local CO concentrations may be explained by recirculation of air that passed over the city during peak mission periods moving back during the early morning and causing violations at the test site.

Chicago data showed only two eight-hour CO NAAQS violations. Both represented very high local contributions ranging from 79 to 97 percent with a 88 percent average. These are characteristic of classical "hot spot" violations.

The authors conclude that they found important differences between various eight-hour CO NAAQS violations. San Jose and Chicago had the expected high local contributions. In Phoenix all violations occurred when local contributions were relatively small. The Phoenix location could not be classified as a "hot spot." Seattle had several violations that could be classified as "hot spot" violations but several others that were area wide violations. The significance of this work is that it shows that it is not always valid to consider CO just a localized problem occurring in the central business district. It could be that with increased total vehicle miles traveled that CO becomes more of an areawide problem.

3. General Motors Submission

General Motors has made a number of comments regarding public health and air quality data in their CO waiver application, in their testimony, and in their later submissions. They maintain that the 3.4 gram/mile standard is not needed for protection of public health. We will address their comments individually.

a. Present CO Air Quality Standards Provide A Substantial Margin of Safety.—EPA has stated on numerous occasions that the present one- and eight-hour NAAQS for CO is designed to adequately protect public health. There is controversy in the scientific literature over what ambient CO levels cause what carboxyhemoglobin (COHb) levels in the blood. The CO NAAQS is designed to prevent blood COHb levels above 2.0 percent saturation in normal populations. According to GM, COHb levels of 1.5 percent are associated with eight-hour CO NAAQS levels. GM apparently feels that this difference represents too great of a margin for safety. In determining the appropriate margin of safety, EPA must consider the relationship between ambient CO and blood COHB levels, the effects of altitude, the impact on highly sensitive individuals such as pregnant women, fetuses, persons with angina, anemic individuals, persons with chronic obstructive pulmonary disease, etc. which represent significant portions of the population. In taking into account these factors the margin of safety does not appear inappropriate.

b. Estimation of a CO Emission Standard to Protect Public Health.—EPA does indeed find that in-use emission rates from the average vehicle exceed the applicable standards by gross amounts for most of the life of the vehicle. This is partly why recent air quality models show the need for lower CO emission standards.

c. Important Assumptions in Calculation of the CO Standard.

(1) Emission Rates.—GM has, in this section, attacked EPA's in-use emission rates as unrepresentatively high and not in agreement with data from the EPA Emission Factor Surveillance Program. They also claim that in-use emission rates for future vehicles will be less than that of present vehicles. The reason given for this is EPA's "parameter adjustment" regulations which are already figured into future year vehicles in MOBILE1.

EPA is in the process of reviewing in-use vehicle emission rates. The emission rates currently being used in MOBILE1 are, as was pointed out by GM in their oral presentation, closed to actual in-use measurements for vehicles with 40,000 miles or less. GM contends that data show a leveling off of emission deterioration after 20,000 to 40,000 miles. EPA has claimed that continued deterioration with age is justifiable as emissions system tampering increases with vehicle age.[9]

GM, in their oral presentation, made a significant point of how EPA has, in MOBILE1, used a deterioration factor (DF) of 1.7 for 1968–1974 and 1975–1979 vehicles but has used a DF of 3.7 for 1980 and later model year automobiles. GM stated that with "parameter adjustment" regulations and future technologies they would expect future in-use emissions to be much lower. EPA, in fact, has assumed this and GM's interpretation is misleading. First, the DF of 1.7 they refer to for 1968–1974 model year vehicles corresponds to a deterioration rate, as used in MOBILE1 and in Reference 6, of 6.15 grams/mile of deterioration per 10,000 miles. The DF of 1.7 GM refers to for 1975–1979 model year vehicles corresponds to a deterioration rate of 2.80 grams/mile per 10,000 miles. The DF of 3.7 GM refers to for "future models" actually in MOBILE1 is applicable only for 1980 model year vehicles and corresponds to a deterioration rate of 2.3 grams/mile per 10,000 miles. For 1981 and future years MOBILE1 assumes a deterioration rate of 2.0 grams/mile per 10,000 miles. It is thus clear that EPA and its MOBILE1 model assume decreasing deterioration rates on a gram/mile basis for newer technology vehicles. The deterioration factors or DF's that GM refers to are not a true reflection of actual vehicle deterioration. The DF's that GM discusses are 50,000 mile emission rate divided by 4000 emission rate. The DF of 1.7 that GM suggests using for future vehicles (Figure 6 of their oral presentation) corresponds to an unrealistic in-use deterioration rate of only 0.75 grams/mile per 10,000 miles for CO.

GM submitted additional information concerning EPA and GM tampering surveys to EPA[10] in response to questions asked at the CO Waiver Public Hearing. GM claims that it's interpretation of EPA's tampering report shows that EPA's contention that tampering increases with car age is fallacious. They claim that tampering, both in the EPA and GM surveys, grows to a certain level and then levels off after a certain number of miles. They claim that in the EPA data (shown in Figure 1 of Attachment C of their additional submission) this plateau has been reached for the 1973 and 1974 vehicles. They neglect to mention that many 1974 vehicles had relatively primitive emissions control systems and are recognized as a low point in LDV fuel economy ratings and *may* not be validly used to extrapolate other vehicle year's emissions. The GM Customer Car Emission Control Modification Survey that GM mentions does show a tapering off of emission control system tampering with vehicle mileage but again details of the GM study are very sketchy, and cannot be used as a basis to modify the in-use deterioration rates.

(2) Growth Projections.—GM presented their concern over EPA's use of a one percent, compounded annually *center city* vehicle miles traveled (VMT) growth rate as being unrealistically high. They claim that birth rates have fallen to replacement only levels and that many mature center city areas are already saturated with traffic. Figure II.C.1. of the GM submission shows U.S. human population growth projections with both a 1.14 percent compounded growth rate (1970–71 growth rate) and the U.S. Bureau of the Census, Series II projection (about a 0.75 percent compounded growth rate). Thus GM assumes that a 0.75 percent growth rate corresponds to what is referred to as "replacement levels." Figure II.C.2. of GM's submission shows VMT growth rate projections for four large metropolitan areas which are also CO non-attainment areas. The cities and their VMT growth rate projections are: Phoenix: 2.5 percent; Los Angeles: 0.75 percent; Chicago: 0.75 percent; New York: 0.35 percent.

(3) "Base Year" Air Quality Data.—GM criticized EPA's use of what they consider to be "erroneously high" base year air quality levels in the "Walsh/Lillis" study [1]. Revised air quality projections have been made by EPA [3,4] for a more recent "base year" (1976) and only two (of 19) AQCR air quality levels were found to have lower base year concentrations of CO.

d. Historical CO Air Quality Trends.—Figure 11.D.1. of GM's submission reportedly shows how CO levels have dropped from about 13 ppm to 5 ppm over the years 1969 to 1977 at the 45th Street monitor in New York City. GM feels that these data reflect a nationwide trend downward in CO levels due to control of motor vehicle emissions. They claim that similar downward trends in CO concentrations have been shown in other large metropolitan areas. GM claims that EPA's rollback model predicts only a 13 percent rather than a measured 59 percent reduction in Manhattan. Unfortunately, Figure 11.D.1. can be characterized as highly questionable as it reports data taken with several instruments, the first of which shows no apparent downward trend and a large amount of scatter.

e. Effect of a Two-Year Waiver on Air Quality.—GM's position is that from their interpretation of air quality data a 7 or 9 gram/mile LDV CO emissions standard is sufficient to achieve the CO NAAQS. They would like to see a permanent relaxation of the 3.4 gram/mile standard. Likewise GM feels that a two year waiver will have no effect on the attainment of the CO NAAQS. GM claims that by using EPA's rollback model with the assumptions they have questioned,[1] they only calculate a maximum total fleet emissions rate 1.96 percent lower in 1987 (the year when there is expected to be the maximum effect) if the waiver is not granted. They further calculate that granting the CO waiver will increase ambient CO levels in Chicago by 0.28 ppm and Spokane by 0.16 ppm, which they feel to be two typical cities, in 1987. They call these levels "insignificant" in view of the uncertainties present in the rollback calculations and assumptions.

f. Cost of Hours of Disability.—GM criticized EPA's projection of the increased personhours of disability related to cardiac disease (from Reference 1) as being insignificant. It should be mentioned that the approximately 5000 personhours of disability projected for the year 1990 by the model if the waiver is granted are only for the 26 AQCR's and only related to cardiac disease. The so called "Three Agency Study"[6] made similar projections of the health consequences of alternate CO emission standards. Although these projections are also dated and apply to slightly different emission standards for slightly offset years, they also project a significant number of additional personhours of disability associated with a higher CO emissions standard.

4. Ford Motor Co.

Although Ford has not applied for a CO waiver, they have kept their option open to do so. They have, however, submitted data and reports which they claim show that the 1980 model year 7.0 grams/mile LDV CO emissions standard is sufficient to achieve the 9 ppm eight-hour CO NAAQS and that a further tightening of the vehicle emission standards is not necessary to protect the public health. Ford has submitted specific reports dealing with each of their comments. These reports are discussed below.

a. Air Quality Effects of a CO Waiver.—In Ford's attempt to "better" analyze the CO air quality data they duplicated the projections of Lillis (from Reference 1), extended that model to include the effects of a 2 year CO waiver, and analyzed seasonal air quality and temperature data from various locations. Although no changes were made in its theoretical basis, EPA has since revised and updated the data inputs into the modified rollback model which Ford used in their modeling efforts. This reduces the ability to compare the two analyses.

Ford's modeling results, using input assumptions from Reference 1, showed small air quality differences due to a CO waiver. Projected air quality, rounded to the nearest ppm, indicated a difference in 1985 of no more than one ppm attributable to granting the CO waiver to the entire industry. They found the variability in the rounding procedure to be more significant than the calculated effect of granting the waiver. If Ford had calculated the rollback modeling results to more significant figures, Ford estimates they would have found that air quality in 1985 would be at most 3.3 percent worse on a CO annual tonnage basis if the waiver is granted. (This 3.3 percent is the change in automobile contributions to total CO.) Ford calculates that an 8 grams/mile CO average in-field performance level would be necessary to achieve the CO air quality standard by 1990 in those areas where stationary sources alone do not exceed the standard (North Alaska). This can be compared to the 16.57 grams/mile CO average in-field performance level calculated by EPA to result from the 3.4 grams/mile LDV CO standard. Ford's projected in-field performance requirement neglects cold-start emissions, vehicle speed effects, and model accuracy.

Ford feels that EPA's rollback model and associated data, as used in Reference 1, understate reductions in air pollution and that emission rates higher than 8 grams/mile average in-use performance figure may be adequate. Ford finds that fall and winter represent periods of higher CO concentrations than spring and summer. They also find that spring and fall represent the extremes in average CO concentrations but not the extremes in average temperature. For 1976 they calculated a correlation of CO air pollution with ambient temperature of —0.25 and conclude that there are other important factors besides temperature which influence ambient CO levels. Ford also presented data from a Chicago CAMP station near an eight lane arterial street which had seasonal CO pollution patterns which suggested what they considered to be a small seasonal effect on CO emissions. Ford did admit, however, that reasons for why greater CO pollution occurs in the fall or winter cannot adequately be explained by stationary source fossil fuel combustion.

Ford finds that air quality data show that significant improvement in CO levels is taking place. They also feel that, based upon this air quality data, EPA's model (from Reference 1) understates expected further reductions in CO air pollution.

b. Prediction of Future Urban Carbon Monoxide Concentrations.—In this section of Ford's submission they discuss their own rollback model and compare the results that it predicts with those from various EPA models. Unfortunately this Ford work is dated (February 1975) and thus is not up to date and not comparable in either their results or data base to EPA's most recent (Reference 4) rollback work. Ford apparently made many different assumptions than EPA in deriving their model. Some of these differences include assuming no vehicular growth in the Central Business District and taking spatial distribution of emission sources into account. Ford claims validation of their rollback model based on its agreement with actual Los Angeles County CO data over the 1965 to 1972 time period. They also claim that their analysis demonstrates that greater weight should be given to the driving pattern in the urban centers where highest CO concentrations are observed. They suggest a revised driving cycle and different FTP weighting factors to increase the weighting of central business district driving.

This entire section (Attachment III of Ford's submission) is not pertinent as the work is out of date, the differences in their model versus EPA's are largely unspecified, the model validation is questionable in both its assumptions and breadth, and some of their suggestions and conclusions appear unsubstantiated.

c. The Vehicle Emissions Standard for CO and Air Quality.—In this section Ford reiterates their position that the Federal Test Procedure (FTP) does not give a correct evaluation of the vehicle emissions responsible for the high CO concentrations observed in center-city locations. Ford claims that the FTP Bag 3 and particularly Bag 1 emissions are weighted too high in comparison to Bag 2 and that the use of these weightings overpredicts the effective CO emissions. Using this logic, Ford claims that a less stringent LDV CO emissions standard of 7.0 grams/mile, as measured on the FTP, is all that is needed as it does, in fact, correspond to a significantly lower effective CO emissions and thereby provides an additional margin of safety for the protection of public health. EPA studies indicate that catalyst equipped vehicles are probably in a "cold start" mode after a soak of only four hours. The EPA "hot spot" study indicates that high CO concentrations are not always a localized problem.

d. Ford's Comments on Two EPA Documents.—Ford commented on two EPA documents entitled "Air Quality Impact of Waiving the 3.4 Gram/Mile Automotive CO Standard" and "Status Report on the CO 'Hot Spot' Project." Both of these reports have been superseded by more recent analyses which are summarized elsewhere in this report. Many of Ford's criticisms have been rectified in the newer revisions of these reports which are discussed in this document.

e. Ambient Temperature Effect on Urban CO Air Quality.—In this submission Ford has

further discussed the sensitivity of CO air quality to the ambient temperature. Ford has modeled results of ambient CO measurements in both New York City and downtown Los Angeles. They have reported, as mentioned in an earlier section, that the dependence of CO concentrations on ambient temperature is weak. They also investigated which meteorological variables such as mixing height, wind speed, and atmospheric stability might have an influence on CO concentrations. Ford found that by analysis of data from the 62 U.S. National Weather Service stations in the contiguous States from 5 year records that slowest dilution episodes occurred most frequently in December, followed in order by January, November, February, and October. This trend agrees well with observed seasonal patterns of 99th percentile CO values. Although Ford agrees that LDV CO emissions arise largely from vehicles in the cold start mode, they feel that their analysis shows that increased CO standard violations in the winter months can be primarily attributed to differences in meteorology.

5. Chrysler Corp.

Chrysler states that their position is that "The protection of public health does not require attainment of a 90 percent reduction for carbon monoxide (3.4 g/mi) by any of Chrysler's passenger car engine families in model years 1981 and 1982." They further state that " . . . postponement of the 3.4 g/mi standard until 1983 would have no meaningful effect on overall air quality . . .." Chrysler has divided their position into the following three arguments:

a. Health Effects of Carbon Monoxide.—Chrysler feels that epidemiological studies have shown that there is no evidence of any relation between ambient CO levels and morbidity or mortality rates among the general public. They also feel that there is no evidence of significant CO-related cardiovascular problems within the sensitive population of angina patients although until a few years ago many cities were in almost daily violation of the present eight-hour CO NAAQS. They claim that the only documented CO health problems are those associated with actual poisoning or asphyxiation. There are a large number of CO health effect studies documented in EPA's CO Air Quality Criteria Document which contradict this view.

b. Ambient Air Quality and Automotive Emissions.—Chrysler states that they feel that the present eight-hour CO NAAQS is sufficient to protect the public health and quote references who state that the present CO NAAQS should be protective of exercising individuals and that it represents an adequate safety margin. They also feel that the one-hour CO NAAQS is adequate.

Chrysler feels measured decreases in ambient CO levels are due to increasing numbers of controlled vehicles. They state that no violations of the one-hour CO NAAQS are presently being recorded and that the downtrend in eight-hour NAAQS violations is so strong that " . . . CO will be the first pollutant to come into compliance with its NAAQS." Chrysler references National Academy of Science, government, industry, and university computer modeling efforts which, they claim, show that a CO emission standard of 9 grams/mile would be adequate to meet the CO NAAQS. Chrysler claims to have used EPA's MOBILE1 model to show that granting of the CO waiver to the entire automobile industry "would slow overall improvement in air quality by only 10 weeks, and to Chrysler by only 11 days." They conclude:

"The 'improvement' in air quality produced by going to 3.4 g/mi, whether in 1981 or 1983, must therefore be judged from any rational perspective as being completely negligible in its effects on the public health."

c. Computer Projections of Future Air Quality.—Chrysler has interpreted and summarized the results of ten computer projections dealing with various automotive CO emission standards. These projections and Chrysler's interpretations are listed below:

(1) F.P. Grad, *et al*; "The Automobile and the Regulation of its Impact on the Environment" (1975).—Chrysler summarizes this book as concluding: "Postponement of the 3.4 g/mi CO standard for five years would have little significant adverse consequences on total aggregate CO emissions in comparison to the reductions achieved since 1967. An interim standard of 9.0 g/mi of CO still results in a reduction of aggregate CO emissions at a rate of 14 percent per year. . . . (T)here is little ultimate difference between a 3.4 g/mi and a 7.0 g/mi standard. Each results in almost the same substantial yearly reduction in CO emissions. The effect of a two year waiver would be even slighter."

(2) 1975 Yale University Study (Partially funded by Chrysler Corporation) (1975).—This study was an evaluation of the 1970 Clean Air Act to assess the adverse health effects of air pollutants emitted from automobiles and the expected benefits to be derived from automobile emission controls. The projections of the report suggested, according to Chrysler, that although reductions in automotive emissions are necessary for a substantial elimination of adverse health effects, the automotive emission standards need not be as stringent as the Clean Air Act requires. Their conclusion assumed that stationary sources would be controlled proportionally. By further comparison with several National Academy of Sciences studies, Chrysler was able to conclude that the Yale study showed that an automotive emissions standard of 9.0 or 15.0 grams/mile would be sufficiently stringent to achieve ambient CO concentrations which would prevent adverse health effects. The problem with this projection is that it predicts that an emission standard of 15 grams/mile would result in elimination of COHb levels and thus adverse health effects by 1981. As we approach 1981 this trend is not materializing.

(3) Denver Air Quality; Colorado Department of Health (1976, 77).—The U.S. DOT has estimated that 99 percent of all CO emissions in Denver are vehicular in origin. Data from the Colorado Department of Health shows a year-by-year reduction since 1971 in the number of one- and eight-hour CO NAAQS violations. These reductions are attributed to reductions in vehicular emissions. The Colorado Board of Health projects 84 and 85 percent reductions in the one- and eight-hour CO standards respectively in Denver by 1975. The U.S. DOT projects no one-hour CO violations in Denver in 1985 and a 75 percent reduction over 1975 data of violations of the eight-hour standard. Chrysler claims that these trends "clearly indicate that present vehicle emissions regulations will bring an end to the CO problem in Colorado within the next few years. . . ." However, no mention is made in Chrysler's Summary as to which emission standards or factors were used for which years to make these projections.

(4) Panel on Air Qualtiy, Noise, and Health, Interagency Task Force (1979).—This report was prepared as a U.S. Government interagency effort to analyze the effects of various air pollution and noise emission limits on air quality, noise, and health implications through the year 2000. This report found that a 7.0 gram/mile LDV CO emission standard would result in a 80 to 85 percent average improvement in air quality from the base year (early 1970's) to the year 2000. Also, in the year 2000 no AQCR's were projected to be in violation of the CO NAAQS at a 9 grams/mile standard. The report also projected possible health consequences of various levels of emissions control for the years 1980, 1990, and 2000, as well as the period 1980 to 2000. They projected that a 15.0 grams/mile standard would be sufficient to reduce all excess cardiac deaths and disability to zero. Chrysler adds that a 7.0 grams/mile standard would thus provide "much more than adequate protection of the public health." Chrysler notes that this projection is based upon each standard being in effect for 23 years (1978–2000) rather than just two (1981–1982) as in the case of the CO waiver. This interagency report is considered to be somewhat dated. Many assumptions are made in the analysis that Chrysler does not detail. Some inspection/maintenance programs are assumed along with very low deterioration rates. EPA considers Reference 4 to be a more reliable source of information as it includes many updates and revisions.

(5) Future Urban Air Quality; Council on Environmental Quality (1977).—In the Council on Environmental Quality's 1977 Annual Report, CO air quality projections were made. They found that with the exception of 16 urban areas, all cities are expected to meet the CO NAAQS by 1985. The 16 cities are also expected to be in compliance by 1990. These calculations are based on rollback modeling using 15 grams/mile as an average, on-the-road automobile emission rate for 1990. Chrysler fails to point out that an average, on-the-road, emission value of 15 grams/mile actually represents a much lower emission standard because in-use deterioration is much greater than is predicted under certification type conditions.

(6) Automotive Air Pollution; National Academy of Sciences (1977).—Chrysler quotes several sections of the NAS report entitled "Implications of Environmental Regulations for Energy Production and Consumption." The first comment states that CO related health problems are important only to people spending many hours in areas

of heavy traffic congestion and that the CO health benefits from a stringent auto emissions standards are minimal compared to those to be gained from CO from cigarette smoke and home gas-fired heaters. The second comment states that "carbon monoxide is not deemed a significant hazard to today's community health at today's (15 grams/mile) emission levels; although the cost of meeting a more stringent standard of carbon monoxide seems low, the added benefits to community health are questionable and the resulting compromise with hydrocarbon elimination should be voided."

(7) Revised Weighting of CVS/CH Test for CO Emissions; Ford Motor Company (1978). Chrysler, in this section, mentions Ford's contentions that FTP CO emissions are not representative of those found in urban rush hour traffic. They suggest Bag 2 emissions as more appropriate. Ford feels that with the present FTP conditions, a CO emission standard of 11–12 grams/mile would be sufficient to meet the CO NAAQS. Again, in this section Chrysler gives insufficient data or analyses to make use of their projection. EPA's "Hot Spot" report gives some indication that CO may be a regional problem.

(8) Air Quality Impact of Waiving the 3.4 gram/mile Automotive CO Standard; EPA (1978).—A revision of this EPA report has been reviewed in the first section of this report.

(9) Effect of a Two-Year Delay on Total Emissions; John B. Pierce Foundation Laboratory (No date).—Chrysler hired the John B. Pierce Foundation Laboratory of Yale University to verify its calculations of the effect of a two-year delay in the imposition of the 1980 and 1981 automotive emission standards on Chrysler cars. Calculations showed that holding the CO standard at 15 grams/mile for 1980 and 1981 Chrysler would, for the 1980–1990 time frame, increase CO emissions by a ratio of 1.0086:1. This represents a six week delay in the attainment of air quality benefits. Chrysler feels that: ". . . Holding at 15 grams/mile for two more years is twice as severe a case as holding at 7 grams/mile instead of 3.4 grams/mile for 1981–82. Nevertheless, delay in the expected decrease of total emissions would be only six weeks. The effect on air quality or public health would be so small as to escape detection with any current methodology."

(10) Chrysler's Application of EPA's MOBILE1: Mobile Source Emissions Model.—Chrysler reports in this section on their use of and projections made with EPA's MOBILE1 model. The emission factors and methodology used are those described in EPA's "Mobile Source Emission Factors, Final Document." Chrysler has modified the program to allow various time-tables for emission standard implementation. Chrysler chose to look at the effects of a CO waiver on air quality in New York and Colorado (as "worst-case" examples), as well as on a national basis. Chrysler found for 1987, the year of maximum air quality effect, a 2.0 percent difference in CO emissions from all manufacturers' vehicles resulted between the waiver and non-waiver scenarios on a nationwide basis. For New York and Colorado the maximum percent differences were 2.7 and 2.1 percent respectively. For a Chrysler only waiver (assuming a 15 percent market share for Chrysler) the maximum nationwide difference in vehicle emissions found to be 0.30 percent while the New York and Colorado differences were 0.40 and 0.32 percent, respectively. Chrysler states that this shows that a two-year waiver would thus have no practical effect on CO emissions or on air quality and public health. They further state that ". . . if a two year waiver to 7.0 grams/mile were granted to the entire industry, the resulting delay in reduction of CO emissions would slow the rate of improvement in air quality by only 10 weeks. If the waiver were granted to Chrysler alone, the rate of improvement in air quality would be slowed by a mere 11 days. It is difficult to believe that air monitoring stations could even detect this difference."

1. Memo from Edward J. Lillis, Chief, Air Management Technology Branch to Michael P. Walsh, Acting DAA, Office of Mobile Source Air Pollution Control, "Air Quality Impact of Waiving the 3.4 g/m Automotive CO Standard," July 18, 1978.

2. Memo from Edward J. Lillis to Michael P. Walsh, "Revised Air Quality Projections for Waiving the 3.4 g/m Automotive CO Standard," August 11, 1978.

3. Memo from Edward J. Lillis to Charles L. Gray, Director, Emission Control Technology Division, "Air Quality Analysis of Waiving the 3.4 Gram/Mile CO Standard for Light-Duty Vehicles," May 14, 1979.

4. "Revised Air Quality Analysis of Waiving the 3.4 Gram/Mile CO Standard for Light-Duty Vehicles," EPA, August, 1979.

5. Memo from Charles L. Gray, Director, ECTD to Robert E. Neligan, MDAD, "OAQPS Support on CO Waiver Requests Under Section 202(b)(5)(a) of the CAA," March 9, 1979.

6. U.S. DOT, EPA, and Federal Energy Administration, "An Analysis of Alternative Motor Vehicle Emission Standards," May 19, 1977.

7. U.S. Environmental Protection Agency, "Mobile Source Emission Factors, Final Document," EPA–400/9–78–006, March 1978.

8. Shelar, E., F. L. Ludwig, and H. Shigeishi, Atmospheric Science Center, SRI International for the U.S. Environmental Protection Agency, "Analysis of Pollutant and Meteorological Data Collected in the Vicinity of Carbon Monoxide 'Hot Spots,'" Discussion Draft, May 1979.

9. U.S. Environmental Protection Agency, "Motor Vehicle Tampering Survey (1978)," November 1978.

10. Additional Submission for CO Waiver Docket from Betsy Anchor-Johnson, Vice-President, GM Environmental Activities Staff, to Benjamin R. Jackson, DAA, EPA Mobile Source Noise and Enforcement, dated July 20, 1979.

[FR Doc. 79–28294 Filed 9–12–79; 8:45 am]

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ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 86

[FRL 1316-3]

Revised Motor Vehicle Exhaust Emission Standards for Carbon Monoxide (CO) for 1981 and 1982 Model Year Light-Duty Vehicles

AGENCY: Environmental Protection Agency.

ACTION: Final rule.

SUMMARY: This regulation establishes CO emission standards for 1981 and 1982 model year light-duty vehicles belonging to certain engine families for which I have granted waivers from the standard otherwise applicable under section 202(b)(5) of the Clean Air Act, 42 U.S.C. 7521(b)(5).

EFFECTIVE DATE: October 1, 1979.

FOR FURTHER INFORMATION CONTACT: Glenn Unterberger, Mobile Source Enforcement Division (EN-340), U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460, (202) 472-9417.

PUBLIC DOCKET: Information relevant to this rule is continued in Public Docket EN-79-4 at the Central Docket Section of the Environmental Protection Agency (EPA), Room 2903B, 401 M Street, S.W., Washington, D.C. 20460 and are available for review between the hours of 8:00 a.m. and 4:00 p.m. As provided in 40 CFR Part 2, a reasonable fee may be charged for copying services.

SUPPLEMENTARY INFORMATION: Section 202(b)(1)(A) of the Clean Air Act ("the Act"), 42 U.S.C. 7521(b)(1)(A), requires that regulations applicable to CO emissions from light-duty vehicles or engines manufactured during or after the 1981 model year shall contain standards which require a reduction of at least 90 percent from CO emission levels allowable under the 1970 model year standards. Regulations implementing this requirement have established a CO standard, often referred to as the statutory standard for CO, of 3.4 grams per vehicle mile (gpm).

Section 202(b)(5) of the Act authorizes the Administrator, on application of any manufacturer, to waive the statutory CO standard for the 1981 and 1982 model years for any light-duty vehicle model regarding which the Administrator can make certain findings. In these cases, the Act requires that I promulgate substitute CO standards for 1981 and 1982 model year light-duty vehicles as discussed below. Applications for these waivers were submitted by American Motors Corporation, BL Cars, Limited, Chrysler Corporation, General Motors Corporation, Toyota Motor Company, Limited, and Volkswagen AG. The statutory criteria, my determinations regarding the criteria with respect to the vehicle models covered by the waiver applications, and my decisions to grant or deny the waiver applications appear in the consolidated decision published above. In that decision, I granted waivers covering the following vehicle models (engine families for purposes of that decision):

Manufacturer	Engine family
American Motors Corp	258 CID.
BL Cars, Ltd	TR8.
	XJ12.
Chrysler	1.7 liter.
	3.7 liter.
	5.2 liter/4V.
General Motors Corp	2.8 liter/173 CID-2V.
	3.8 liter/231 CID-2V.
Toyota Motor Co., Ltd	88.6 CID.

Having decided to grant waiver applications for some vehicle models, the Act requires that I simulatenously promulgate regulations adopting a standard not permitting CO emissions from 1981 and 1982 model year vehicles of these vehicle models in question to exceed 7.0 gpm. Moreover, I must promulgate regulations establishing this standard no later than 60 days after I receive the waiver application in question. The public has received an opportunity to comment on the waiver applications at issue, and I have considered those comments in making the consolidated decision which requires the promulgation of this rule. For these reasons, I find that providing notice and an opportunity to comment on this rulemaking before final promulgation is impracticable and unnecessary.

Note.—The Environmental Protection Agency has determined that this document does not contain a major proposal requiring preparation of an economic impact analysis under Executive Orders 11821 and 11944 and OMB Circular A-107.

Dated: September 5, 1979.

Douglas M. Costle,

Administrator.

40 CFR Part 86 is amended as follows:

Subpart A—General Provisions for Emission Regulations for 1977 and Later Model Year New Light-Duty Vehicles, 1977 and Later Model Year New Light-Duty Trucks and 1977 and Later Model Year New Heavy-Duty Engines.

1. 40 CFR 86.081-8(a)(1), published at 44 FR 47884 (August 15, 1979), is revised to read as follows:

§ 86.081-8 Emissions standards for 1981 light-duty vehicles.

(a) (1) Exhaust emissions from 1981 and later model year light-duty vehicles shall not exceed the following levels for the following pollutants:

(i) Hydrocarbons—0.41 grams per vehicle mile;

(ii) Carbon monoxide—3.4 grams per vehicle mile, except that carbon monoxide emissions from light-duty vehicles of the following 1981 and 1982 model year engine families shall not exceed 7.0 grams per vehicle mile:

Manufacturer	Engine family
American Motors Corp	258 CID.
BL Cars, Ltd	TR 8.
	XJ12.
Chrysler Corp	1.7 liter.
	3.7 liter.
	5.2 liter/4-V.
General Motors Corp	2.8 liter/173 CID-2V.
	3.8 liter/231 CID-2V.
Toyota Motor Co., Ltd	88.6 CID.

(iii) Oxides of nitrogen—1.0 grams per vehicle mile, except that oxides of nitrogen emissions from 1981 and 1982 model year light-duty vehicles manufactured by American Motors Corporation shall not exceed 2.0 grams per vehicle mile.

(Sections 202 and 301(a) of the Clean Air Act, as amended, 42 U.S.C. 7521 and 7601(a).)

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